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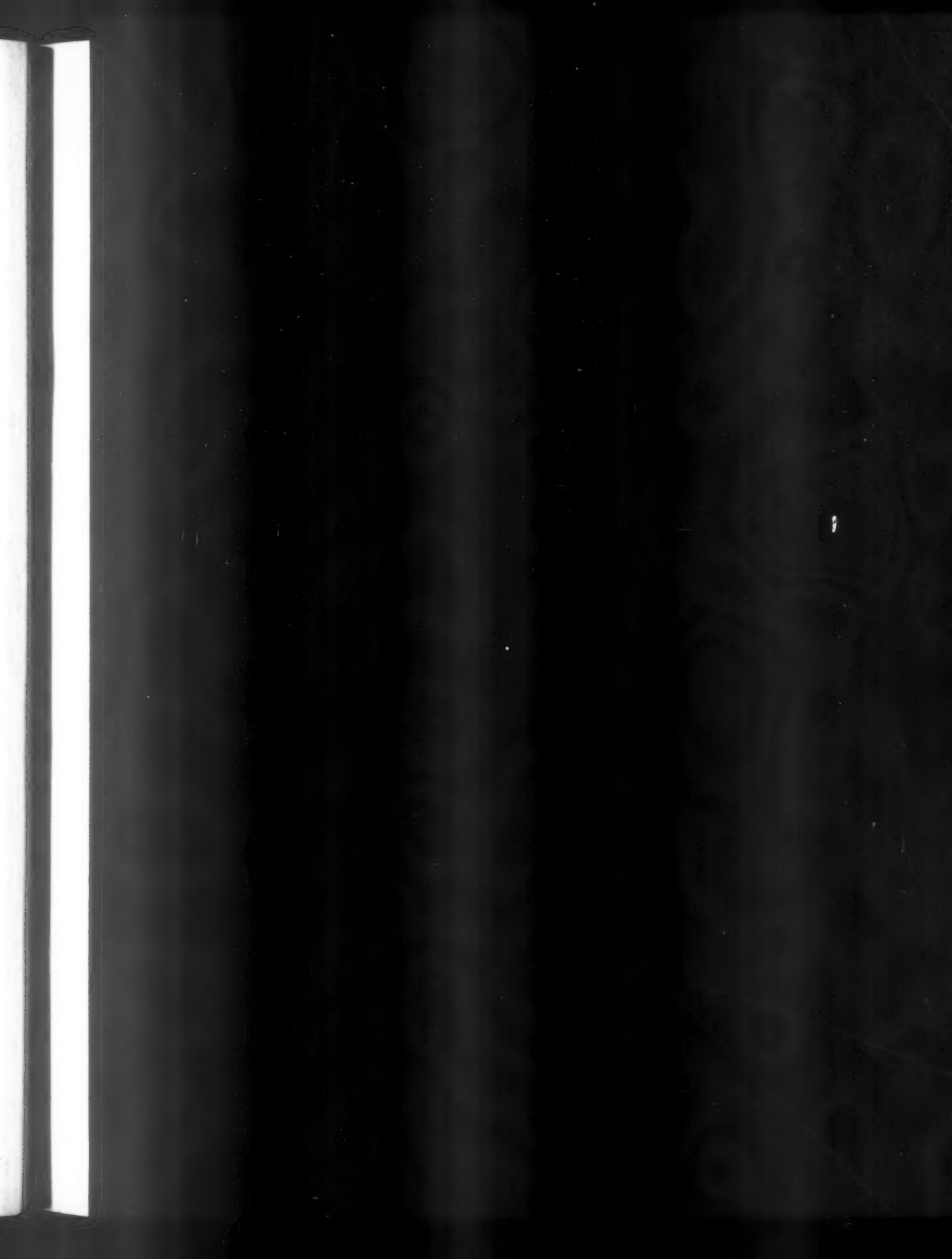


Municipal Engineering

VOLUME XXI. JULY, NINETEEN HUNDRED ONE. NUMBER 1.

A NEW SEPTIC SEWAGE DISPOSAL PLANT.

By Colin R. Wise, C. E., Passaic, N. J.

The authorities of Liberty, N. Y., a noted summer resort, situated among the western foothills of the Catskill mountains, and located on the line of the New York, Ontario and Western Railroad Company, decided, early in 1895, to build a sewer system, and commissioned the writer's firm to prepare the necessary plans and specifications therefor.

The plans, as prepared, provided for the "separate system" of sewers, and for the purification of the sewage by "downward intermittent filtration."

Although these plans, etc., were at once approved by the state board of health of New York, nothing further was done in the matter until the spring of 1899, when the tax-payers, at the regular village election, authorized the sewer commissioners to issue bonds for, and proceed with, the construction of the system.

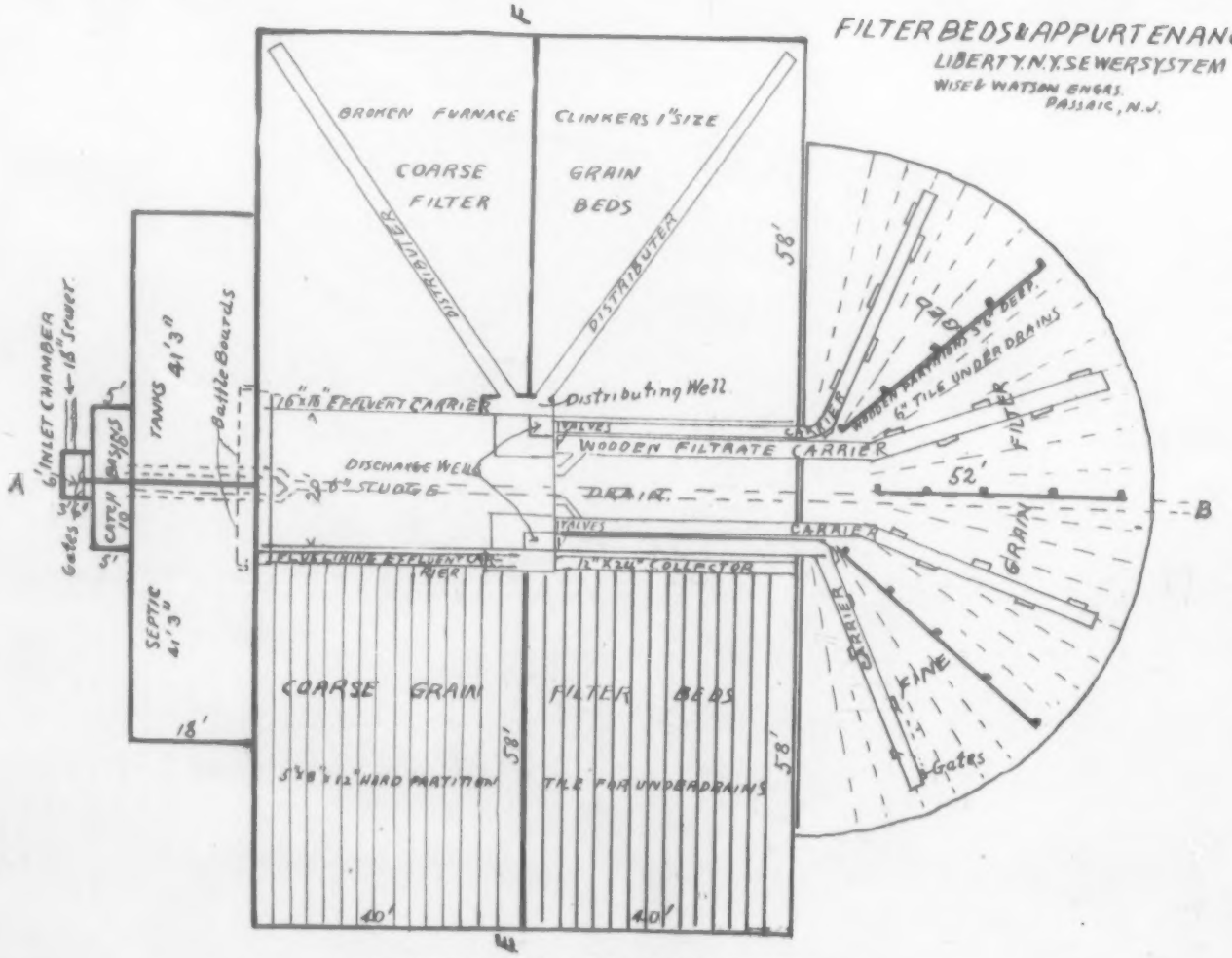
The area which had been selected for the filters was upon the right bank of the Mongaup river and outside of the corporate limits of the village, but in plain view of some of the large boarding-houses and residences along the heights in the lower portion of the village. As a matter of policy, and in deference to the wishes and interests of the owners of these boarding-houses and residences, it was decided, if feasible, to locate the disposal plant further down the stream and more out of sight, and Messrs. Wise & Watson were instructed to make further investigation. This was done and resulted in the selection of a site for the disposal works upon the right bank of the river, about half a mile below the location originally chosen for the filters.

Respecting the method to be adopted for the purification of the sewage, careful consideration of the entire situation led to the adoption of the "septic tank," coupled to "contact filters," as the best, and the plant was accordingly built upon those lines.

The plant, as constructed, comprises a small valve chamber, catch basins (in duplicate), septic tanks (in duplicate), four coarse grain contact filters, and a semi-circular, downward, intermittent, fine-grain filter, partitioned off into octant beds. It was intended that each of the fine-grain beds should receive only the filtrate from the contact bed, to which it was connected by a wooden filtrate carrier. As a fact, however, the coarse-grain (contact) beds divested themselves of their contents so much more rapidly than had been anticipated, that the filtrate from each contact bed overflowed the entire surface of the four fine-grain beds. Among the contemplated improvements to the plant are the setting of valves in the discharge ports of each of the contact beds, which will afford complete control of the flow from them.

The sewage of the village reaches the disposal works in a sewer 18 inches in diameter, the last quarter of a mile of which has a fall of only 0.12 per 100 feet. From this outfall sewer the sewage passes, first, into a small valve chamber, 3 feet 6 inches by 6 feet in plan, which communicates with twin catch-basins, each 5 feet by 10 feet by 9 feet 6 inches in depth, intended to catch all heavy substances in the sewage, such as sand, gravel, etc. These basins in turn communicate with a pair of septic tanks or chambers, each 18 feet by 41.25 feet by 9 feet in depth, through six inlets, each in area equal to 1½ square feet, and located in the partition walls between the basins and the septic tanks, about three feet above the bottoms of the latter.

We have found that the catch-basins, as constructed, have, to a large degree, been acting as the true septic tanks, for in them



A. PLAN OF SEWAGE DISPOSAL PLANT, LIBERTY, N. Y.

we find the characteristic scum present upon the surface of the septic tanks generally. This scum on February 12 last was 18 inches in thickness in the catch-basins, while it was merely a thin overspread in the septic tanks. Indeed, it had at one time almost disappeared, whether because of the effect of the extremely low temperature (4° to 12° Fahr.) or because of high dilution of the sewage, we can only conjecture. An anomalous condition respecting the sewage of Liberty may be said to exist. Owing to the unusual volume of sub soil water and quicksand encountered during the construction of the sewer system, it was practically impossible to prevent the entrance of ground water to the sewers to a large degree. During the months of July and August the ground is dry and very little subsoil water enters the sewers. These are the months, however, when the "season" is at its height, and the volume of sewage in its most concentrated form is greatest, and yet the volume of sewage entering the septic tanks has been found to vary little from 200,000 gallons per day, under all conditions. This volume is equivalent to an entire change of sewage in the septic tanks in twelve hours.

After passing through the septic tanks, the effluent falls into carriers, 16 inches by 16 inches inside diameter, made of flue lining, laid beneath the surface of the locomotive furnace clinker of the two coarse-grain beds adjacent to the septic tanks. These carriers terminate in distributing wells, from which the effluent is distributed, automatically, to and upon the surface of the coarse-grain beds by means of a tipple apparatus, actuated by the filtrate from the contact beds. From the distributing wells a wrought-iron trough or carrier, with four holes, each 1 inch in diameter, every 7½ inches, conveys the effluent to each contact bed. These carriers are embedded in the surface of the filtering medium. The filtering medium of the coarse-grain beds consists of furnace clinker or cinder so broken as to pass a screen with a 1-inch mesh and be retained on one with a mesh of ¼-inch. The average depth of the medium is three feet.

On the concrete floor of the coarse-grain or contact filters are underdrains of hard partition tiling, in rows 3½ feet apart and terminating in collectors situated at the sides of the beds next to the distributing wells. These collectors communicate with discharging wells located in the space between the two sets of contact filters, each filter or bed, as will be seen by referring to the plans, having its own discharging well. In the space between the discharging wells is located the automatic distributing and discharging machinery. In operation, the filtrate in the discharging wells rises with, and to the same height as, that in the contact beds, until it reaches the level of the discharging troughs, which are at the same level as the surface of the filtering medium of the contact beds. It then flows through

B. LAYING TILE DRAINS UNDER CONTACT FILTER BEDS. LIBERTY, N. Y., SEWAGE DISPOSAL PLANT.

the troughs into buckets, which, as soon as they are filled, drop, and, in so doing, actuate sliding shutters attached to the inner ends of the wrought-iron distributing carriers and so control the direction of the flow of the effluent. At the same time the gate valves in the discharging wells are, respectively, raised and lowered, permitting the draining of the bed just filled and the filling of the bed just drained. The filtrate then flows upon and over the fine-grain beds. The latter are composed of furnace clinker broken so as to pass through a screen with a mesh of ¼-inch and be retained on one with a mesh of ⅛-inch, and are three feet in depth. They are underdrained by strings of round tiling, laid with open joints.

This disposal plant has been in operation for so short a time that little opportunity has been had to obtain data which would justify any conclusions as to its working. Analyses made for us by Mr. Geo. C. Whipple, biologist of the Mount Pleasant Laboratory, Brooklyn, N. Y., in February last, seem to indicate that the septic tank is effecting a reduction in the amount of organic matter of about 40 per cent. The coarse-grain filters effect a further purification, and when it leaves the beds, about 65 per cent. of the organic matter has been removed. A further purification takes place in the fine-grain beds, so that the purification of the whole plant is about 85 per cent. Mr. Whipple gives the following as the percentage of removal, etc., viz.:

Turbidity (silica standard)	83.7 per cent.
Organic matter represented by the loss on ignition	91.2 per cent.
Nitrogen as albuminoid ammonia	83.7 per cent.
Oxygen consumed (which represents carbonaceous matter)	86.4 per cent.
Bacteria	92.4 per cent.

The rate of flow through the coarse-grain filters is equivalent to about 900,000 gallons per acre per day, and that of the fine-grain filter equivalent to about 2,050,000 gallons per acre per day. This latter is too high a rate, and the filter must before long be enlarged.

Owing to the fact that there is so little difference in elevation between the bottom of the contact filters and the top surface of the fine-grain filter, there is afforded opportunity for giving only a limited amount of aeration to the filtrate before it reaches the latter, or secondary filter. We believe it very important that the filtrate from the primary filters be aerated to as high degree as possible before it passes to the secondary filter.

Among the changes contemplated to be made in the plant to increase its efficiency are, first, the making of a direct surface connection between catch basins and septic tanks; second, the placing of longitudinal partitions in the septic tanks, to extend almost their entire lengths, to force the sewage to traverse a greater distance in the tanks, and, third, increasing the area of the fine-grain filter, possibly converting it into a contact filter.

A description of the accompanying illustrations will make the operation of the plant clear. The sewage enters the inlet chamber, shown at the left on Plate A, through the 18-inch sewer as indicated. Gates turn the sewage into one or the other of the catch basins shown, the plant being in duplicate. From the catch basin it flows through cast-iron inlets near the bottom into the septic tank, on the same level. The man shown standing in Plate D has open before him a part of the cover of the catch basin. He is standing on the covering of the septic tanks near a man-hole entrance. The cement platform extending each side of him and behind him to the man stooping is the cover of the septic tanks. The overflow from the septic tanks passes under the baffle boards shown and thence through the flue lining formed effluent carrier to the distributing well as shown in Plate A. This carrier is near the top of the wall between the contact bed and the excavated passage lying between the beds, which is seen in Plate D. The distributing wells, as well as the apparatus for turning the effluent of the contact beds to different sections of the fine filter are under the roof shown in the center of Plate D. The septic tank effluent flows by turns into one or the other of the diagonal carriers shown in Plates A and D, and is thence distributed over the surface of the cinders with which these contact beds are filled, and which are filled and emptied alternately as described above. The clarified effluent is collected in the tile drains shown in the lower beds in Plate A, and runs to the discharging wells under the roof, whence it runs alternately to one section or another of the fine grain filter bed. Plate B shows the placing of these tile drains during the construction of the work, and Plate C shows all the walls of the tanks and beds and a wagon unloading cinders over these tile drains, and filling the beds with them. The tipple apparatus for changing the flow of septic tank effluent on the beds is located under the roof, below the bottom of the contact beds. The carriers for distributing the effluent from the contact beds over the surface of the fine filter bed are

C. PLACING CINDERS IN CONTACT FILTER BEDS. LIBERTY, N. Y., SEWAGE DISPOSAL PLANT.

D. COMPLETED SEWAGE DISPOSAL PLANT, LIBERTY, N. Y.

shown in the drawing, Plate A, also the wooden partitions intended to separate the bed into four practically separate sections. The semi-circular form of the bed is indicated in Plate D, but the carriers do not show, and the partitions are, of course, entirely concealed. The broken lines in Plate A under the fine grain filter bed show the locations of six-inch tile drains. The Mongaup river flows near the trees in the background and the effluent from these tile drains flows into it. The sludge from the catch basins and septic tanks can be drawn through the sludge drain shown in Plate A, to a sludge well located near the point B in that plate, and there disposed of in a proper manner.

NEW BOOKS ON WATER SUPPLY.

[1]PUBLIC WATER SUPPLIES. REQUIREMENTS, RESOURCES AND THE CONSTRUCTION OF WORKS. By F. E. Turneaure, C. E., Professor of Bridge and Sanitary Engineering, and H. L. Russell, Ph. D., Professor of Bacteriology, University of Wisconsin. With a chapter on Pumping-Machinery by D. W. Mead, M. Am. Soc. C. E., etc. 8vo. xiv + 746 pp., 231 figures. Cloth, $5. 1901.

[2]TOWERS AND TANKS FOR WATER-WORKS. THE THEORY AND PRACTICE OF THEIR DESIGN AND CONSTRUCTION. By J. N. Hazlehurst, M. Am. Soc. C. E., etc. 8vo. ix + 216 pp. Cloth, $2.50. 1901.

[3]WATER-WORKS DISTRIBUTION. A PRACTICAL GUIDE TO THE LAYING OUT OF SYSTEMS OF DISTRIBUTING MAINS FOR THE SUPPLY OF WATER TO CITIES AND TOWNS. By J. A. McPherson, A. M. Inst. C. E. Illustrated by 19 full-page diagrams and 103 other illustrations in the text, together with a large chart of an example district, showing distribution. 154 pp. Cloth. $2.50. 1901.

[4]WATER FILTRATION WORKS. By James H. Fuertes, M. Am. Soc. C. E. 12 mo. xvi + 285 pp. 45 figures and 19 half-tone plates. Cloth, $3.50. 1901.

The almost simultaneous appearance of so many books on the subject of water supply, which follows that of quite as many others, at comparatively short intervals, indicates that the recent advances in this line are so great and so rapid that the need of recording them in permanent form has been felt by many engineers.

The first book listed above has been prepared "with particular reference to the needs of teachers and students in technical schools in which the subject of water supply receives a considerable amount of attention." This makes it equally valuable to engineers desiring to make a full study of the subject and as a book for constant reference on questions of good practice. It is written by professors whose knowledge is largely theoretical and is thus largely a compilation of the investigations of others and the results of the experiences of others as reported in papers before engineering societies, articles in technical publications, monographs and other books. The chapter on pumping machinery, however, is written by an engineer who recognizes the value of careful theoretical consideration of a problem, and is eminently practical in his application of the results of such study to the actual design and construction, and it thus has a flavor of actual contact with the work. The authors of the book are well fitted by nature and attainments to make a well-selected and well-digested compilation of this sort, and it is probable that they have made a better-balanced book, and one which gives a more satisfactory view of the whole field, than would have been written by an engineer in actual practice, who must of necessity be a specialist in some of the lines treated and have a tendency to over-elaboration upon such lines.

A very valuable feature for the specialist, or the engineer who is making a study for a special design, is the list of books, monographs and periodicals which follows each chapter and gives the sources to which reference can be made for the data for the special studies necessary. There are about 750 titles in these lists of references.

The introduction gives twelve pages of a historical sketch and a discussion of the importance of a public water supply.

Part I treats of the requirements and resources of water supplies, under the headings of "Quantity of Water Required," "Sources of Supply" and "Quality of Water Supplies," with chapters on each of these subjects in detail, as well as upon rainfall, evaporation and percolation, flow of streams, ground-water, examination of water supplies and communicable diseases, in all occupying 185 pages. This part covers about the same ground as the first eight chapters of Folwell's[5] "Water Supply En-

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[5]WATER SUPPLY ENGINEERING. The designing, construction and maintenance of wa-

I. Before Improvement.

II. After Improvement, showing deep cut.

PASSAIC AVENUE, HUDSON COUNTY, NEW JERSEY. TELFORD.

gineering," in slightly more detail, and with some differences in selection of material. It brings the first nine chapters of Fanning's[6] book on water supply down to date, the advances in our knowledge, especially of the quality of water supplies, having been very great since the date of the earlier book. It does not go into the details of methods of analysis and examination so thoroughly as Mason[7] or Nichols[8], not having the specialist so much in view as the former in this regard, but it is sufficiently full for the practicing engineer, and a most excellent guide to a more detailed study in its manner of treatment and its list of special treatises.

Hill[9] and Fuertes[10] discuss the special sanitary questions in more detail, but the conclusions they reach are no better stated than in the chapters of this book written by Mr. Russell.

Part II treats of the Construction of Water-works, and occupies 535 pages. Chapters on the general arrangement of water-works, the principles of economic construction and the elements of hydraulics are followed by several chapters on works for the collection of water, and others on works for the purification and for the distribution of water. Under the first heading are considered intakes from rivers and lakes, springs, the hydraulics and the construction of wells and galleries, impounding reservoirs, earthen, masonry, timber, steel, and loose rock dams. Under the second heading are chapters on the objects and methods of purification and detailed accounts of sedimentation, sand and mechanical filtration, and short accounts of a number of less important methods. Under the last head are chapters on pipes, cast and wrought iron, steel, wood, and other materials; on conduits and pipe-lines; on pumping machinery; on distributing and equalizing reservoirs, including standpipes and tanks; on the distributing system and on operation and maintenance.

Some comparison of the treatment of these subjects in this book with those in the more specialized books listed at the head of this article, as well as with other well known books, may be of value.

Upon the elements of hydraulics the amount of space expended is comparatively small, as a fair knowledge of this subject should be expected, and there are books, like Merriman's Hydraulics,[11] which can be read by any engineer, and cover the ground more completely than would be possible in a book devoted to one of the applications of the science. Mr. Turneaure's book,[1] therefore, devotes only 36 pages to the subject, Mr. Folwell's[5] gives the same space, while Mr. Fanning,[6] not having the modern books to which to refer, must occupy a whole section, over 170 pages, with the details of this subject.

The section on works for the collection of water occupies about 150 pages, about 50 pages more than Fanning[6] or Folwell,[5] and the satisfaction given to the reader may perhaps be measured by the ratio of numbers of pages. Certainly the treatment in the new book is comprehensive, and leaves little to be desired as a general treatment of the engineering features. Mr. Fanning's[6] chapters have the advantage of the author's actual contact with much of the work described, and the same is true to some extent of Mr. Folwell's;[5] but Mr. Turneaure[1] has the advantage of being last in the field and has selected the good things that are new with excellent discrimination as well as given the less valuable contributions to practice the space their importance requires.

In the matter of purification of water, very nearly the same can be said. With Hazen,[12] Fuller[13] and Hill[9] preceding so closely, little new can be recorded. Credit should be given for the excellent summary

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ter-supply systems, both city and irrigation. By A. Prescott Folwell, M. Am. Soc. C. E., etc. 562 pp. $4. 1890. Reviewed in MUNICIPAL ENGINEERING, on page 365, November, 1900.

[6] HYDRAULIC AND WATER SUPPLY ENGINEERING. By J. T. Fanning, M. Am. Soc. C. E., etc. 644 pp. $5. 1877, 1886.

[7] WATER SUPPLY. Considered principally from a sanitary standpoint. By William P. Mason. 504 pp. $5. 1896, 1898. Reviewed in MUNICIPAL ENGINEERING, on page 40, July, 1899.

[8] WATER SUPPLY. Considered mainly from a chemical and sanitary standpoint. By Wm. Ripley Nichols. 232 pp. $2.50. 1883.

[9] THE PURIFICATION OF PUBLIC WATER SUPPLIES. By John W. Hill, M. Am. Soc. C. E. 304 pages. $3. 1898.

[10] WATER AND PUBLIC HEALTH. By James H. Fuertes, M. Am. Soc. C. E. 75 pages. $1.50. 1897.

[11] A TREATISE ON HYDRAULICS. By Mansfield Merriman, 381 pp. $4. 1889.

[12] THE FILTRATION OF PUBLIC WATER SUPPLY. By Allen Hazen, 321 pp. $3. 1895, 1900. Reviewed in MUNICIPAL ENGINEERING, p. 132, February, 1900.

[13] REPORT ON THE INVESTIGATIONS INTO THE PURIFICATION OF THE OHIO RIVER WATER AT LOUISVILLE. By Geo. W. Fuller, $10. 1899. Reviewed in MUNICIPAL ENGINEERING, p. 40, July, 1899.

III. Before Improvement.

IV. After Improvement.

EAST PASSAIC AVENUE, ESSEX COUNTY, NEW JERSEY. TELFORD.

of results and methods and the good judgment of the relative proportion of the subject to the whole, which is shown.

Mr. Fuertes'[4] new book takes up rather more nearly in the manner of a specialist the subject of works for the filtration of water, including a few pages on the prevention of pollution. So far as the works themselves are concerned, his chapters are no more satisfactory than those of Mr. Turneaure and Mr. Russell[1] and are perhaps not so well arranged, but in the detail of the operations of cleaning, refilling and managing the flow of water and the filtering material, he shows more intimate knowledge of the actual work done and in this regard his book will be the most acceptable of any upon this subject which has yet appeared. He is also quite full in the descriptions of special conveniences in construction and operation, in details where much money can be saved or the works rendered more efficient. Mr. Folwell[5] gives but a single chapter and about 40 pages in all to this subject, and Mr. Fanning[6] about the same.

No more satisfactory chapter on pumping machinery than Mr. Mead's[1] has appeared in a treatise on water supply. It is on quite a different plan from that in Folwell.[5] It omits, perhaps intentionally, any reference to the boiler room, and in this regard, as well as in some details of operation, is not so satisfactory, though the chapter as a whole is more comprehensive and puts the principles of the action of the various kinds of pumps in the best shape for easy practical use.

Conduits and pipe-lines for supply are treated much alike in the two books, Turneaure[1] being somewhat more extensive.

The same may be said of the consideration of the distributing system, but here Folwell[5] gives some practical details of construction and of maintenance and operation, which are very valuable to the young practicing engineer, and show actual contact of the author with the work. Mr. Turneaure's[1] book gives much fuller consideration of the theory of the design of the network of pipes in a distribution system and makes a valuable addition to the discussion of this much neglected subject. McPherson's[3] book is, according to its title, devoted entirely to the design of distributing systems, and about one hundred pages are so occupied. This is an English book, by a man with twenty-four years' experience in this particular line, apparently in the smaller systems. Many of the principles upon which his work is based are not applicable under the conditions in America of greater use and much greater waste of water, of greater fire risks and consequent more complete provision for fire service. Some of the details given would be classed as very poor practice under our conditions. The last fifty pages are occupied by details which belong in this country to the plumber's part of the work rather than the engineer's, and with descriptions of meters and recording gauges for various purposes, many of which, while good, are quite different from practice in this country.

Mr. Hazlehurst's[2] book takes up the subject of stand-pipes and elevated tanks in detail from the chemical and physical properties of structural metals and a comparison of different metals, through a consideration of the mechanical principles involved in the stability and the design of the tank, of the design itself, including foundations and superstructure, riveting, painting, shop practice and erection of the tower or tank. It is a book long needed. Pence's excellent little book on stand-pipe accidents has been the only guide, and it did not claim to cover the whole field. Apparently Mr. Hazlehurst is familiar with good design and good construction and his book is one which the practicing engineer will find to be a convenient guide or a valuable check upon the results of his own investigations. It goes into details much more fully than either Folwell[5] or Turneaure[1], naturally, but it is interesting to note how fully the latter book, especially, covers the general principles of the design, as developed by Mr. Hazlehurst, though it is lacking, of necessity, in detail on the subjects of foundations, painting, shop practice, methods of erection, and to some extent of riveting.

The book on maintenance and operation of water-works plants is yet to be written. All the books upon water supply have been written by or for designing and constructing engineers, and no engineer or superintendent has yet put the results of his experience and his study into permanent form. There are several engineers in the country fully competent by training and experience to write such a book in a form which would be acceptable.

Mr. Folwell[5] devotes several chapters, about 60 pages, to the subject of maintenance and operation, including the clerical and financial sides. This is the best which has yet appeared, and is all that could be expected in a general work on water supply. Mr. Turneaure[1] gives one chapter, about 15 large pages, to the same and fills the

V. Before Improvement.

VI. After Improvement, showing 24-foot cut.

CENTER STREET, ESSEX COUNTY, NEW JERSEY. TELFORD.

space well. Until the specialists' book is written these two will serve as guides for individual research.

Another new book should be considered in this connection. Its scope is fully given by its title. It is the outgrowth of Mr. Schuyler's[14] work for the United States Geological Survey upon water supply and irrigation, and gives, in good shape, with many illustrations from drawings and photographs, descriptions of the important dams, especially of those for irrigation purposes, which have been built in the west, with quite full reference to many in other localities. The work is nearly all large work and is of much value to the engineer entering upon the study of such problems as an expert report upon what has been done in this line.

[14]RESERVOIRS FOR IRRIGATION, WATER POWER AND DOMESTIC WATER SUPPLY. With an account of various types of dams and the methods and plans of their construction; together with a discussion of the available water supply for irrigation in various sections of arid America; the distribution, application and use of water; the rainfall and run off; the evaporation from reservoirs; the effect of silt upon reservoirs, etc. By James Dix Schuyler, M. Am. Soc. C. E., etc. 432 pp. 183 figures. 25 plates. Cloth, $5. 1901.

ROAD IMPROVEMENT IN NEW JERSEY.

The work of road improvement in New Jersey has been in progress long enough to have its effect upon public opinion, and the roads can not now be built as rapidly as they are desired, owing to two limitations. One limits the amount the state can pay to twenty-five per cent. of the cost of the road, and the amount expended in any one year to the appropriation made for that purpose during the year; the other limits the rate of local taxation for road purposes to one-quarter of one per cent. of the valuation of taxable property. Pressure is being exerted to set both these limits forward, and the probabilities of success are increasing each year.

Since the establishment of the department of public roads there has been a constant endeavor to fit the character of the road to the character of the traffic and of the soils upon which it is located, as nearly as the amount of money available, the necessities of the case and the cost of materials permit. Our illustrations give views of a number of the newly constructed roads, and the following descriptions, taken from the last annual report of the Commissioner of Public Roads, indicate the principles upon which the designs are based and some of the methods of meeting the local requirements:

The first two plates (I and II) show Passaic avenue before and after improvement. This avenue runs through the towns of Kearny and Arlington, in Hudson county, along the easterly bank of the Passaic river. In the former town it passes large thread and linoleum works, and is subject to heavy loads, some of fifteen tons having passed over it since its completion. This portion is of 10-inch telford construction, under the standard specifications of the department. In the town of Arlington the road is built of 8-inch macadam. The picturesque country through which it runs is indicated in the illustration, which also shows one of the most important improvements in the line, the reduction in grades, which amounts to a change of maximum gradient from 13 per cent. to 8.86 per cent. The total cost for 2.44 miles is itemized as follows:

Width of stone bed	20 feet.
Length of stone bed	12,900 feet.
Depth of stone bed	10 inches.
2,144 square yards of macadam at 80 cents cost	$16,915.20
7,556 square yards of telford at 80 cents cost	6,044.80
24,250 cubic yards of earth excavation at 24 cents cost	5,820.00
150 lineal feet of tile drain at 50 cents cost	75.00
Supervisor's salary	546.00
Engineering expenses	1,442.75
Total cost	$30,843.75

The stone cost 70 cents a ton at the quarry and the freight charge was 30 cents a ton, 12,310 tons being used.

Another road in the same vicinity is shown in the next four plates (III, IV, V and VI). This road is built of telford eight inches thick. Here, too, there was a material reduction in grades, the maximum gradient having been reduced from 14 per cent. to 7.5 per cent. The illustrations show deep cuts made to reduce steep hills. The roads of this district were through a glacial drift, and short, sharp hills are frequent. The towns of Bloomfield and Franklin are connected by the pavement, which is partly on East Passaic avenue and partly on Center street, in Essex county. This district is be-

VII. Before Improvement, Greenland Hill.

VIII. After Improvement, Roe's Hill.

coming more densely populated each year, and is in close proximity to the city of Newark, and thus subject to much traffic, which in some sections is very heavy. The cost of the East Passaic avenue and Center street pavement, 1.4 miles long, is itemized as follows:

Width of stone bed	16 feet.
Length of stone bed	7,334 feet.
Depth of stone bed	8 inches.
13,251 square yards of telford at 52 cents cost	$6,890.52
1,677 square yards of cobble gutter at 72 cents cost	1,207.44
24,455 cubic yards of earth excavation at 33 cents cost	8,070.15
Total cost	$16,168.11

The stone cost 75 cents a ton at the quarry, and 4,900 tons were used.

The remaining illustrations are of roads in the southern part of the state, ten to twenty-five miles south of Philadelphia, in a district largely devoted to truck farming for the Philadelphia and other city markets.

Plates VII, VIII, IX and X show views of the Woodbury and Knights Run gravel road in Gloucester county, running in a southerly direction from Woodbury, 5.26 miles. A gravel road was intended, but scarcity of material required the use of stone for the southern end, largely increasing the cost. Overhaul on gravel and heavy cuts also swelled the expense, which is itemized as follows:

Length of gravel bed	19,068 feet.
Length of macadam bed	8,700 feet.
Total length of road	27,768 feet.
Width of gravel bed	14 feet.
Depth of gravel bed	10 inches in center, 6 inches on sides.
Width of macadam bed	12 feet in city, 10 feet in township.
Depth of macadam bed	8 inches.
27,768 lin. feet road bed prepared at 10 cents	$2,776.80
1.01 acres grubbing at $50.	50.50
14,429 feet of tile drain at 15 cts.	2,164.35
20,311 cu. yds. extra excavation at 25 cents	5,077.75
7,014 cu. yds. gravel (compacted) at 47 cents	3,296.58
2,071 cu. yds. overhauls at 25 cts.	517.75
1,197 cu. yds. overhauls at 50 cts.	598.50
1,019 cu. yds. overhauls at 75 cts.	764.25
258 cu. yds. overhauls at $1	258.00
2,932 cu. yds. stripping at 25 cts.	733.00
10,268 sq. yds. macadam at 42 cts.	4,312.56
5,874 cu. yds. gravel at 10 cts. and 5,468.8 tons stone at $1.55, less $100 discount	8,964.04
Committee expenses, advertising and printing	$117.30
Supervisor's salary	666.00
Engineering expenses	706.18
Total cost	$31,003.56

About one-sixth the work was done the previous year. The maximum gradient was reduced from 10.8 per cent. to 4.3 per cent. The excessive cost of stone will be noted, also the high cost of the gravel delivered on the work. The soil is sandy loam or sandy clay.

Plates XI and XII show a road still further south, part of the road from Mullica Hill to Woodstown, completing it to give an outlet to the latter town. This road is also of gravel, 2.045 miles long. Its cost is itemized as follows:

Width of gravel bed	14 feet.
Length of gravel bed	10,788.5 feet.
Depth of gravel bed	8 and 6 inches.
Total cost of gravel purchased in bank	$265.82
Preparation of road bed	755.19
Compact gravel, 3,263.1 cu. yds. at intersections at 39 cts	1,272.60
Earth excavation, 520 cu. yds. at 25 cents	130.00
Overhauls, 1,263.6 cu. yds. at 56c.	707.62
1,390.6 cu. yds. at 84c.	1,168.10
193 cu. yds. at $1.12..	216.16
Open drains, 610.4 cu. yds. at 25c.	152.60
Supervisor's salary, 58 days at $3.	174.00
Engineering expenses	115.05
Total cost	$4,957.14

But little reduction in gradients was made on this road, the maximum being reduced from 7.33 to 6.97 per cent.

The opinion is prevalent that the New Jersey system of suiting the cost of the coat to the pocket of the wearer is practically successful. Certainly the roads in the state are less expensive in proportion to the travel over them than in some other states. They are scarcely old enough as yet to show whether the material is too thin, or not of good enough quality. This will not be a very important question, however, if the question of road supervision and repair is properly considered. There is a valuable paper on road repair by the State Supervisor in the Commissioner's report which should be closely followed. The first expense of good roads is not the only expense. They can not be kept in good condition without attention and the addition of proper materials. It is undoubtedly true that the expense of maintenance will be greater than that of unimproved roads, but if it is prop-

IX. Before Improvement.

X. After Improvement.

WOODBURY AND KNIGHTS RUN GRAVEL ROAD, GLOUCESTER COUNTY, NEW JERSEY.
NORTH OF PUMPING STATION.

erly done the increase in expense will be slight.

The truck farmers of southern New Jersey are being converted by the object-lessons before them and are calling for more good roads. Possibly they have more loads of produce to haul than the ordinary farmer, so that the value of the improvement will be greater. It is undoubtedly true that much of his produce must reach its market promptly or it is valueless, and good roads increase the area available for this class of products as well as reduce the cost of getting them to market. But it is just as true that the farmer who can not get to market at will is at a disadvantage, in paying storage or in taking low market prices, while his more favorably situated or more far-sighted competitor on a good road can sell his product on a high market.

Enough of New Jersey is in business requiring prompt marketing to make good roads a necessity, and nearly 150 miles were built last year. Over 500 miles have been built under the state aid law.

MUNICIPAL OWNERSHIP.

By L. N. Case, Supt. of Water-Works, Duluth, Minn.

Municipal ownership, in its broader sense, is state or national ownership of interurban or interstate utilities, such as railroads, telegraphs and telephones.

There being no distinction, however, as to their origin, installation and operation, or to the effect upon the people, the only difference being their limitations, the use of the term municipal has been accepted as applicable to the ownership of all public utilities by the people, whether city, state or nation. In this broader sense I shall treat of it in this article.

From an argument in favor of the nationalization of railroads, presented with a bill to that effect in the senate of the United States, I glean the following facts:

The total capitalization of the railways in the United States is 10,800 million dollars, which is divided almost equally between bonds and stocks, the former representing and fully covering the structural value of the roads, the latter representing nothing but their theoretical earning power.

One-fifth of these bonds receive no interest, so utterly bankrupt are the roads they represent, and fully three-fifths of the stock receives no dividends whatever.

Another accompanying feature of this unhealthy condition is the fact that 156 roads, representing one-fourth of this capitalization, are in the hands of receivers, a condition that is undoubtedly caused by over-capitalization, in proof of which is the fact that in the New England group of states that have legislative restrictions preventing this, there is but one road in the hands of a receiver.

In addition to the evil of over-capitalization, resulting in non-dividend paying stocks, defaulted interest, receiverships, foreclosure sales and consequent utter worthlessness of values in the hands of innocent purchasers, is the greater evil of discrimination, an evil that is corroding and ruinous to the fair, honest and equitable interests and rights of the people.

In the argument referred to there was cited the fact that in a period of eighteen months the Standard Oil Company had compelled the railroads to charge its competitors 80 cents a barrel, while it, itself, paid but 30 cents, and that it had forced the roads to pay this extra 50 cents into the treasury of the said company, which amounted, in the period mentioned, to ten million dollars.

It was also shown that a manufacturer whose output amounted to 35,000 barrels of oil per month, marketed over 70 per cent. in Europe, because there his oils were carried as cheaply as those of the Standard, while in this country, so greatly was he discriminated against that it was practically impossible for him to compete in this market with the Standard. It was further shown that large establishments could ship goods from Chicago to New York at 35 cents per 100 pounds, while others had to pay 75 cents, which means a difference of $80 per carload.

Discrimination is always in favor of the strong against the weak, and is in violation of the underlying principle, nay, the very life of all common law.

Looking back into the dim vista of the ages, we see a time when there was no law—when might made right—when the strong preyed upon the weak, taking by force whatever it wanted wherever it was found.

We can imagine a time coming when the weak recognized the fact that they were

XI. Before Improvement.

XII. After Improvement.

MULLICA HILL AND WOODSTOWN OLD TURNPIKE. GRAVEL. SALEM COUNTY, NEW JERSEY.

largely in a majority, and, getting together, passed their first crude law that death should be the penalty of the spoilsman.

Let us hope and believe that history will repeat itself! Let us hope and believe that the people will awaken to the fact that their rights and privileges are invaded; that that which is necessary to their comfort and happiness is being despoiled, and that these public utilities that naturally belong to the people, because their operations are conducted on the public property *of* the people, and are practically but furnishing those things that are necessary *to* the people, must be owned and operated *by* the people.

I say let us hope—and there is much reason to hope—when we hear that in London, England, it was decided at a recent election, by an overwhelming majority, that the public should henceforth own and operate its water, gas and electric light plants, its street cars and its telephones; and this in a country that makes no claim that its government is "of the people, for the people, and by the people."

The world moves, and the time is surely coming when the people of these United States will cease to wait until their very lives are jeopardized and lost, as was the experience of Duluth, but will arise in their majesty, and, with the strong arm of power that they possess, wrest from the hands of private operators that which they have innocently and ignorantly parted with in the past, and in whose private operation their trust has been abused, and their right to an equitable, honest and economical service been completely ignored.

EDITORIAL COMMENT.

Septic Tank Action. Our knowledge of the principles of the action of the septic tanks is as yet very limited, and the conditions in detail which will produce the best results are still less known. There are many indications that the strength of the sewage, its state of decomposition, the temperature, the character of manufacturing refuse contained in it, and so forth, have quite marked effects upon the efficiency of operation of a tank, and that this efficiency can be greatly increased by proper modification of the time and rate of passage through the tank, temperature and chemical condition. Some tanks have been comparative failures under conditions apparently quite as favorable as those of tanks producing satisfactory results.

When further purification through contact or filter beds is desirable, another complication is introduced, as the condition of the septic tank effluent seems to affect the action of the filter, and a proper attention to this condition promises an increase in the efficiency of the filter.

With the concentrated sewage of Manchester, and the condition of the manufacturing refuse contained in it, satisfactory purification has been obtained by the methods developed from the recent extensive experiments there, as described in MUNICIPAL ENGINEERING in May, 1901. Other English experiments are reported in that number and in earlier numbers. It is hardly possible to apply these results directly to American conditions and expect the same success. Further experiments must be made and at present it seems to be necessary to make these experiments for the conditions of each new city adopting the system. If the works are small, these experiments can well be made on the completed works, such portions as are liable to change as a result of the experiments being somewhat temporary in their first construction. In some cases designs have been made in which such changes as are thought possible are arranged for in the plans, so that they can be made at a minimum of expense. If the works are large, small-scale experiments must be made to secure the information upon which to base the design for the large works, according to the plan so satisfactorily applied in English cities. The experiments by the Massachusetts State Board of Health and by the city of Pawtucket, R. I., are of this nature and are upon the sewage and factory refuse of cities of some size. A recent installation of a small experimental plant at Cornell University for the study of a pure house sewage will be of interest to the smaller cities having separate sewer systems. In this case the earlier experiments promise to be more particularly upon various forms and methods of filtering the septic tank effluent and the effect of various rates of flow through the septic tank upon the filter effluent. New problems will arise for a time more rapidly than they can be studied effectively. The Washington University experiments will give additional light upon somewhat different conditions. The plan for these experiments was discussed in our January number of this year.

Attention is called to the good statement of results at the Liberty, N. Y., plant in this number. During the summer this plant has house sewage to treat, and during the winter it has about the same amount of cleaner water. The plant has been in operation long enough to give some idea of the method of the management necessary to get good results for the sewage treated. Our readers are indebted to Mr. Wise for so frank a statement of the difficulties met with and the changes found necessary, quite as much as for the description of the plant as constructed. His report is a valuable contribution to our limited knowledge regarding the action of the septic tank.

Typhoid Bacillus in Soil. Typhoid fever has usually been considered a water-borne disease, and the continued existence of the bacillus in a dry state has not usually been conceded. Dr. Sidney Martin has been making some investigations for the English Local Government Board which throw some light upon this subject. He finds that if the soil from cultivated gardens and yards is sterilized and then inoculated with the typhoid bacillus, it will gradually be filled with the germs, if there is a certain amount of moisture present, while soils which have never been fertilized with animal or human excrement tend rapidly to extinguish the effect of the inoculation. In the first class of soils the bacillus has been found alive after more than a year's time has elapsed, while it has disappeared entirely from the second class within two or three days in some cases. Some desiccation is even possible in the cultivated soils, though a few days in the dry state is sufficient to destroy the bacilli.

The action seems to be quite different, however, if the ordinary soil is inoculated without previous sterilization. In such case the myriads of other bacteria present in the soil may destroy the typhoid bacillus very promptly. If we should judge from the bacteriological examinations alone, this would seem to be true in the case of water also, since it is extremely unlikely that any specimen of this bacillus will be found in a sample of running water, though known to be seriously polluted with the dejecta of typhoid fever patients. The spread of epidemics of the fever from the use of such water indicates the presence of the germ, though it can not be isolated by any of the methods known. This makes it possible that failure to find typhoid bacilli in soil known to be infected may be due to the failure of our present methods to separate that organism from its numerous companions of numerous species. In some of Dr. Martin's later experiments he inoculated favorable sterilized soil with a single species of bacteria in addition to the typhoid bacillus. Some of these were able to drive out the disease germ, others could do so at some temperatures, but were overcome by it at other temperatures less favorable to their growth and more favorable to the typhoid bacillus. Inoculation of unsterilized soils at lower temperatures and with less moisture showed a longer life for the typhoid bacillus than in earlier experiments.

Thus far it may be said that the work throws a doubt on the ability of soils to destroy the typhoid germ under all conditions, and does not show what conditions insure safety. The former conclusion has been reached by some students of well pollution, and Dr. Martin's results are valuable pointers in the study of the characteristics of soil purification.

Patents and Sewage Purification. Our editorial with this title, which appeared in the June number, is not entirely satisfactory to the officers of the American Sewage Disposal Company of Boston, as will be seen by reference to a communication from Mr. McClintock of that company, in another department of this magazine. Although several other communications on this subject have been printed we insert this one that there may be no claim that we are suppressing the information, but this communication does not add anything to the stock of knowledge upon the subject, and does not modify the opinions expressed in the editorial referred to. Our readers are now in possession of all the statements of claims which have been made and they will not be again repeated. Each one will form his own opinion, which will be satisfactory to him, until the matter is decided in the courts. This is the only way in which the claims of the company can be definitely settled; but, so far as we can learn, no suit has yet been started, although the number of possible infringers of the patents is increasing almost monthly. Until that time opinions will be free and, according to present indications, will many of them be against the validity of the claims of patentees.

The Water Meter Question. Some newspapers of a prominent city of Pennsylvania and some councilmen seem to consider the water meter as a public enemy which can not be destroyed too quickly.

One editorial throws a sop to the advocates of meters by saying:

It is safe to say that the department of water will grade the rates in such a manner that the "big fellows" will continue to pay for all the water they use. The likelihood is they will pay more than they now pay. There's where the small consumer would reap the benefit.

The meter system has been in vogue long enough that the amount of water used by each class of consumers is known almost to a certainty. It is a matter of simple mathematics to prepare a scale of rates corresponding in ratio to the volume of consumption as indicated by the meters now in use. The test has been established. It will stand good through years to come.

If this is true there are only two reasons why meters should not be introduced: If the people of the city are all as careful of the water as they would be if they paid the bills for delivering it to their rooms directly out of their own pockets; if the pipes and fixtures are all tight and there is no leakage, visible or invisible; if the people are all honest and there are no unauthorized or surreptitious uses of water, a system of flat rates prepared as proposed would be perfectly equitable and the expense of meters could be saved. Also, if the supply of water is at all times unlimited and it will cost nothing for extensions, the question of waste is of no consequence, and every tap may run all the time without let or hindrance.

Unfortunately, one city is no better than another in the first respect and every water supply has its limitations in plain sight. Something must then be done, not to restrict the use of water, for no advocate of meters wishes to do that, but to restrict the waste of water. The American people are long-suffering and will accept a large amount of inconvenience, or even expense, rather than demand their rights when some one loudly proclaims that his rights would be trampled upon. But the fact is that much of the waste of water, of which almost all American cities complain, is little short of highway robbery, and nine water consumers must have their water rates doubled that the tenth may permit his taps to run because it is too much trouble to turn them off, or because he wants cool water, or because his pipes are not properly protected and might freeze, or because he does not want to pay a plumber, or take a little trouble to stop a leak or mend a fixture, or because he can and will use water for uses for which he does not pay. The one consumer is discommoded by a regulation permitting the water commissioners to inspect his premises, or enabling them to require payment for all the water running through his pipes, and he makes himself heard and felt, so that in the absence of any complaint from the nine consumers whose overpayments, distributed in small amounts, have not been brought home to them, the city council and the politicians looking for good will and for votes, and therefore some of the newspapers, raise the usual cries and frequently succeed in stopping the inquiry into their dishonest, or careless and therefore dishonest, abuse of their privileges.

It is sometimes necessary to apply meters to all services to prevent claims of unfair discrimination, and such procedure is found to be to the advantage of both consumer and water department, but frequently a right to apply meters where undue waste or unauthorized use of water should be checked is all that is necessary.

In short, we are not all careful and we are not all honest. The meter does good to those who are both, by reducing their payments to the amounts actually used, and by reducing the total expenses of the supply and thus permitting reductions in rates. It only affects those who are abusers of the service, and affects them, if careless, but temporarily, until they become accustomed to the new methods. The water thief should have no consideration shown him, no matter what his influence may be.

The meter is a good trap to catch thieves, intentional or unintentional, and when they are caught, they try to escape by raising the counter-cry of robbery and invasion of rights, with some help from that of unsanitary conditions.

Comparisons of Municipal Statistics. An interesting and valuable feature of the Chicago Bulletin of Statistics, dated May, 1901, is a comparative table of revenues and expenditures of twenty American cities for the year 1900. Sufficient detail is given to make a comparison fairly satisfactory. The diversity in methods of bookkeeping and accounting and reporting is shown by the notes explanatory of items, which must be taken into account, if the comparisons are to be strictly upon the same basis. Such facts as this show the reasons for the discussion of methods of securing uniformity in accounting and reporting and should aid in advancing the cause.

Even without reference to the notes mentioned, the following tables, arranging the cities in the order of their standing in the various items, will be of interest:

Population.		*Bonded Debt Per Capita.*		*Taxes per Capita.*		*Revenues Per Capita.*		*Total Expenditures Per Capita.*	
New York	3,437,202	Boston	$145 53	Boston	$28 72	Boston	$86 22	Boston	$78 63
Chicago	1,698,575	New York	114 04	New York	21 03	New York	55 98	Providence	54 62
Philadel'a	1,293,697	Providence	93 60	Providence	17 57	Providence	55 71	New York	54 07
St. Louis	575,238	Jersey City	93 32	Pittsburg	16 75	Pittsburg	50 90	Pittsburg	33 86
Boston	560,892	Cincinnati	82 83	San Fran'co	16 63	Jersey City	34 42	Jersey City	31 40
Baltimore	508,957	Baltimore	78 59	Buffalo	12 80	Washington	33 09	Washington	26 43
Cleveland	381,768	Pittsburg	68 86	Minneapolis	12 80	Philadel'a	32 47	San Fran'co	26 24
Buffalo	352,387	St. Paul	55 68	Philadel'a	12 79	San Fran'co	28 64	Philadel'a	23 67
San Fran'co	342,782	Washington	54 14	Detroit	12 60	Cincinnati	25 08	Buffalo	21 80
Cincinnati	325,902	Buffalo	45 55	Jersey City	11 99	Cleveland	24 61	Cincinnati	21 09
Pittsburg	321,616	Philadel'a	42 45	Baltimore	11 48	Buffalo	24 24	Baltimore	20 12
Detroit	285,704	Minneapolis	41 31	Louisville	11 47	Minneapolis	23 46	Minneapolis	19 47
Washington	278,718	Louisville	40 32	Washington	10 83	St. Louis	23 28	St. Paul	18 89
Jersey City	206,433	Cleveland	34 42	Cincinnati	10 56	Detroit	23 03	Cleveland	18 09
Louisville	204,731	St. Louis	33 21	Kansas C'y	8 72	Baltimore	21 63	Detroit	17 65
Minneapolis	202,718	Detroit	23 28	St. Paul	8 21	St. Paul	19 58	St. Louis	15 51
Providence	175,597	Kansas C'y	22 40	St. Louis	7 35	Chicago	18 86	Chicago	15 37
Indianapolis	169,164	Indianap's	12 62	Chicago	7 20	Louisville	14 70	Louisville	13 65
Kansas City	163,752	Chicago	9 61	Cleveland	5 01	Kansas C'y	13 72	Kansas C'y	9 19
St. Paul	163,065	San Fran'co	0 72	Indianap's	4 13	Indianap's	8 48	Indianapolis	8 30

EXPENDITURES PER CAPITA.

For Schools.		*For Police.*		*Fire Protection.*		*For Health.*		*Street Cleaning & Garbage Disp.*		*Lighting.*	
Boston	$6 62	N. Y.	$3 24	Boston	$2 20	San Fran	$0 64	Boston	$2 00	Prov.	$1 70
Minneap	5 64	Boston	2 96	Detroit	1 99	N. Y.	0 30	N. Y.	1 47	Boston	1 29
Wash	4 37	St. Louis	2 81	Prov	1 99	Boston	0 30	Pittsburg	1 34	Cincin	1 03
Indpls	4 34	San Fran.	2 56	Buffalo	1 84	Indpls	0 30	St. Paul	1 10	Buffalo	0 97
N. Y.	4 24	Wash	2 34	San Fran.	1 80	Pittsburg	0 25	Minneap	1 05	N. Y.	0 96
Chicago	4 07	Phila	2 28	Minneap	1 59	Wash	0 24	Wash	0 83	Pittsburg	0 94
Prov	3 78	Buffalo	2 19	Pittsburg	1 47	Kan. City	0 24	Buffalo	0 82	St. Paul	0 88
San Fran	3 71	Prov	2 05	Cincin	1 41	Phila	0 23	Indpls	0 77	Phila	0 86
Phila	3 61	Chicago	1 98	N. Y.	1 32	St. Louis	0 22	Baltimore	0 75	Wash	0 83
Detroit	3 12	Jer. City	1 97	Louisville	1 31	Cleveland	0 16	Detroit	0 73	Jer City	0 82
Jer. City	2 82	Detroit	1 95	St. Louis	1 28	Baltimore	0 15	Phila	0 73	Baltimore	0 76
Buffalo	2 80	Baltimore	1 77	St. Paul	1 25	Buffalo	0 14	Cincin	0 69	St. Louis	0 73
St. Paul	2 73	Cincin	1 75	Cleveland	1 24	Jer. City	0 13	San Fran	0 61	Indpls	0 72
Pittsburg	2 50	Pittsburg	1 51	Kan. City	1 23	Prov	0 13	St. Louis	0 56	San Fran	0 69
Baltimore	2 39	Louisville	1 43	Jer. City	1 19	Cincin	0 12	Cleveland	0 51	Louisville	0 67
Louisville	2 17	Kan. City	1 38	Indpls	1 08	Detroit	0 12	Louisville	0 50	Indpls	0 66
.....		St. Paul	1 17	Chicago	0 92	Minneap	0 11	Prov	0 50	Cleveland	0 60
.....		Cleveland	1 04	Wash	0 90	Chicago	0 10	Chicago	0 47	Chicago	0 53
.....		Minneap.	1 04	Baltimore	0 89	St. Paul	0 05	Kan. City	0 35	Kan. City	0 47
.....		Indpls	0 88	Phila	0 82	Louisville	0 04	Jer. City	0 28	Detroit	0 42

In comparing expenditures, the difference between total receipts and receipts from taxes must be considered, for there is considerable difference in the method of treatment of temporary loans, and they swell both the receipts and expenditures in some cases. Also it will be noted that several cities are missing from the column of expenditures for schools. In some other cases also the receipts and expenditures for schools are not included in the totals.

A comparison of the cost of street cleaning and garbage disposal per mile of street and of lighting per mile of street, changes the order of the cities very materially, as shown in the table arranged on this basis. It is perhaps more satisfactory than the comparison of cost per capita. Both are dependent upon the density of population in the city, large areas of comparatively unoccupied and unimproved territory reducing both amounts very materially. A comparison of costs per mile of street actually served would be more complete, and a statement of the length of paved streets would throw some light upon the character of the street cleaning required. Under the present lack of system these figures are hard to get in proper form:

Cost of Street Cleaning and Garbage Disposal per Mile of Street.		*Cost of Lighting per Mile of Street.*	
Boston	$2,298 88	Boston	$1,488 97
New York	2,026 07	New York	1,322 66
Pittsburg	1,880 53	Pittsburg	1,317 69
Baltimore	1,020 73	Providence	1,312 19
Washington	827 80	Baltimore	1,038 93
Philadelphia	633 60	Jersey City	850 49
St. Paul	468 97	Washington	828 46
Buffalo	448 04	Philadelphia	780 11
Detroit	419 05	Cincinnati	543 44
Indianapolis	396 51	Buffalo	530 45
Providence	385 87	St. Louis	484 74
St. Louis	372 05	Cleveland	409 44
Cincinnati	362 68	Louisville	409 24
Cleveland	345 33	St. Paul	374 76
Louisville	302 64	Indianapolis	338 60
Jersey City	288 07	San Francisco	315 93
San Francisco	278 80	Detroit	235 97
Minneapolis	270 55	Chicago	218 36
Chicago	193 25	Minneapolis	186 58
Kansas City	128 68	Kansas City	171 50

THE QUESTION DEPARTMENT.

BOOKS ON SANITARY SEWERAGE.

Please give me a list of the best books on sewerage, telling how to build a city sewer for sanitary sewerage. *A. B. Codding, County Surveyor, York, Neb.*

Staley & Pierson's "The Separate System of Sewerage" ($3) gives the most detailed instruction regarding the design of systems on the separate plan and regarding the laying of pipe sewers. Folwell's "Sewerage" ($3) gives much detail also and extends its discussions over both the combined and the separate systems. Being very little larger, the details are not quite so full on account of this broader field. Ogden's "Sewer Design" ($2) takes up the principles of sewer design and does not consider the details of construction. It covers about the same ground as the same number of pages in Folwell's book. For review of these three books see page 90, August, 1900.

SEWER CONNECTION FOR LAUNDRY.

Will you kindly inform me what is the most up-to-date plan for making sewer connections for steam laundries and bath houses? Do you consider hot water detrimental to vitrified pipe sewers? *Subscriber, Great Falls, Mont.*

Direct connections are very common. It is not probable that the water is hot enough to injure the pipe. Sudden changes in temperature would probably in time crack and spall off the glazing and perhaps finally destroy the pipe, but this action would nearly all of it take place in the branch connection. Where there are large amounts of grease, or the chemical condition of the water is detrimental to the sewage at a disposal plant, a small settling basin, in duplicate, if necessary, and a grease-trap, may be required, also proper attention to keeping them clean.

STANDARD FOR REJECTION OF MACADAM STONE.

Our specifications call for macadam stone of a certain kind, or stone equally as good. In the standard abrading machine 5 hours, 10,000 revolutions, the standard stone lost 4.02 per cent. and another stone lost 4.85 per cent. Is the greater loss sufficient to reject this other stone? *City Engineer, ——, Iowa.*

The excess in loss of the new stone over the standard is about 20 per cent. of the loss in the standard stone. There is a difference in loss of the same lime stone, wet and dry, of nearly 30 per cent. of the loss of the dry stone. A difference in the condition of moisture in the two stones might therefore account for a considerable part of the loss from abrasion. There is also a considerable variation in samples of the same stone. Unless, therefore, there are other characteristics which would suggest the rejection of the stone under trial, it would be well to make some additional tests before deciding upon absolute rejection. Other characteristics would usually decide for or against the acceptance of the stone, independently of this comparatively small difference from the standard in resistance to abrasion.

CONCRETE STREET PAVEMENT.

I would like to know through the columns of your valuable paper the method of constructing a concrete street pavement finished in the same manner as macadam as used in Europe, and, I think, in the United States. *S. Cameron Corson, Borough Engineer, Norristown, Pa.*

A concrete macadam introduced by Mr. J. Mitchell was laid in some places in Scotland, and may be one of those referred to. The mixture consisted of one part of Portland cement, one and one-half parts of sand, and four parts of broken stone, and was laid in two layers, each three or four inches thick in the center and an inch thinner at the sides. After the subgrade was properly formed and rolled, the first layer was put in place and left a few days to set, when the second layer was put on and compacted with a heavy hand roller. It takes about three weeks for the roadway to harden sufficiently to permit traffic over it. Although some of these pavements lasted ten years without repairs they do not seem to have been popular.

A concrete pavement at Bellefontaine, Ohio, was laid by a somewhat different method, being constructed somewhat after the manner of cement sidewalks. The specifications for this pavement and a report on its condition after ten years' wear will be found on page 427 of the number of MUNICIPAL ENGINEERING for December, 1900. Some views of a similar pavement laid in New Orleans during the past year, with description of the process of laying, will be found on page 341 of MUNICIPAL ENGINEERING for June, 1901.

OWNERSHIP OF ENGINEERS' NOTE-BOOKS.

An engineer in general practice performs the duties of city engineer under appointment of the mayor, approved by the city council, keeping his notes for all work in similar form and style. When a new city engineer is appointed, to whom do the notes belong? *Subscriber, ——, Ohio.*

Some discussion of this subject will be found on page 331 of MUNICIPAL ENGINEERING for December, 1899, which suggests principles for the decision of the question of ownership for several different classes of notes. The city engineer's notes, referred

to by our correspondent, seem to belong to the class which is considered somewhat analogous to the records kept by a bookkeeper. The city engineer is employed, on salary probably, to perform certain duties, and an important part of those duties is the proper preservation of records of all work done, much depending in the future upon the possession of these records in good condition for easy reference. It is customary, in such cases as our correspondent describes, to keep the notes of city work separately, with the expectation that they will be turned over to successors. No records of court decisions are at hand, but it is quite probable that they would be in this line. The records belonging to a public office are generally open to public or semi-public reference and copy, so that there can seldom be any objection to the engineer retaining copies of all notes of city work which he may have done; in fact, in some instances, where complete separation of private and public notes has not been made, the engineer has retained the original and filed exact copies in the office on retiring from it. This method of procedure, however, opens the door to question and difficulty, and both engineer and public will be better satisfied if complete separation of the two classes of notes is insisted upon and the originals of public work are filed in the proper office, copies being retained by the engineer if desired.

THICKNESS OF RESERVOIR WALL.

How thick should a concrete wall be for a reservoir 50 feet in diameter with a perpendicular wall 10 feet high, half below the original surface and half above, with embankment on the outside? Will the same thickness of brick hold as well? How thick should concrete be laid on a bottom of joint clay?

E. Blankenstein, Temple, Tex.

The thickness will depend upon the character of the earth filling and of that in the sides of the excavation. If it is good soil, well compacted, and is drained, naturally or artificially, so that water or frost will not affect it, much less thickness will be necessary than if the wall must support a wet, loose mixture, the reservoir being empty, or has the poor backing which such a soil not properly confined may give, the reservoir being filled. The wall, if of concrete or brick, would be from two to four feet thick at top and from three to six feet at base, the lighter wall corresponding to the best material.

Either brick laid in cement mortar, or concrete, can be used. Either one should be made water-tight.

If there is no danger of the bottom rising under any circumstances, including the weight of the wall and embankment, a thickness of concrete of 3 or 4 inches on the bottom should be sufficient. If it can be made water-tight, or the soil is not easily washed away or affected by slight leaks, 3 inches may be enough.

See the answer in this department under heading, "Construction of a Small Reservoir."

BOOKS ON CONSTRUCTION OF ELECTRIC LIGHTING PLANTS.

Please give the names of a few books best suited to give instruction on the design of small electric lighting plants.

J. J. Smith, City Engineer, Grand Forks, N. D.

The following are good books in this line: Atkinson's "Elements of Electric Lighting," including electric generation, measurement, storage, and distribution, $1.50; Crocker's "Electric Lighting," a practical exposition of the art for the use of engineers, students, and others interested in the installation or operation of electrical plants, $1; Guy's "Electric Light and Power," giving results of practical experience in central-station work, $2.50; Abbott's "Electrical Transmission of Energy," a manual of design of electrical circuits, $4.50. Munro and Jameson's "Pocketbook of Electrical Rules and Tables," for the use of electricians and engineers, $2.50, may also be found useful.

CONSTRUCTION OF A SMALL RESERVOIR.

We propose a reservoir of a half-million gallons capacity on a hill of 110 feet rise a half-mile from the center of town, instead of a standpipe. The hill is of rock in layers two to six inches thick, and we think an excavation of 15 feet with a wall 15 feet above, would make a good job. Which would be the best material to use, stone or concrete? Should the reservoir be round or square? What effect will freezing have? What books treat on these points?

A. Flesher, Leesburg, Ohio.

If the hill is not too irregular in shape, the reservoir walls can follow its form in the best way to insure a secure position of the embankment forming the upper part of the reservoir, and make the line between the natural surface and the filled embankment as nearly horizontal as possible, that the strength of the reservoir may be uniform all round. The engineer who lays out the work can work out the detail and a few hours spent in surveys and computations may save considerable handling of rock, and perhaps later trouble. He will determine from the data he obtains the depth of cut and height of embankment.

If the embankment can be made very substantial and at the same time can be

made to shed all water falling on it or allow it to drain out promptly away from the reservoir, the sides of the rock cut and fill will answer for the walls of the reservoir. Some slope should be given them, the amount to be determined by the engineer making the design and familiar with the materials. The bottom and slopes must be made perfectly water-tight. A common method of doing this is to cover them with a Portland cement concrete, finished off with a coat of Portland cement mortar. It is sometimes necessary to add a thin coat of asphalt, especially if there is a liability of settlement of the embankment portion, but this is not often so. If the reservoir can not be made tight, as shown by seepage from it appearing after filling, or by a gradual disappearance of the water, this asphalt coat can be laid later. The engineer may think it advisable to cover the bottom and slopes with a clay puddle. This must be carefully done and the layer protected from drying out or from getting too wet and sliding down. Frost may also affect it if not properly kept out. Stone paving, laid in cement mortar or concrete, may be used.

Regularity of form of the reservoir is desirable, but exact circular or rectangular form is not necessary if the topography of the hill does not readily permit.

One reason for giving slope to the sides is that ice forming on the surface may have the least effect upon them.

Wegman's "Design and Construction of Dams" ($5) is devoted to this subject entirely. Three books reviewed on a preceding page in this number have many things of value in a study of these questions: Turneaure's "Public Water Supplies," Folwell's "Water Supply Engineering" and Schuyler's "Reservoirs for Irrigation, Water Power and Domestic Water Supply."

STAINLESS CEMENTS.

I wish to know who are importers of LaFarge cement and Meier's Puzzolan; also the names of American manufacturers of stainless Portland cements. *N. B. Winter,*
Cincinnati, O.

Information on the first points is given in the lists of foreign cement manufacturers, foreign cement brands and sales agents in the "Directory of American Cement Industries and Hand-book for Cement Users." There are several manufacturers of pozzuolana (slag cements) in the list of American cement manufacturers, and descriptions of their works in the chapter on that subject. The names of the brands will also be found in the list of brands of American cements. Some of these pozzuolanas are said to be stainless, while others do not make the claim. The Charles Warner Company have a stainless cement, the Blanc brand, which, it is stated, is not a pozzuolana. There are other plasters and cements, not classed as hydraulic cements, which are stainless. Most of them, however, will not stand exposure to the weather.

EXPANSION OF TOP COAT OF CEMENT PAVING.

Is it a fact that, if the top coat of cement paving is put upon a concrete surface that has fully set, the expansion of the top coat will be greater than if the concrete bed had not set fully? Is the expansion of the top coat due to the heat of the sun, and if so, how can the slipping of the top coat on the concrete be prevented? *Subscriber,*
Augusta, Ga.

If the pavement is a compact, homogeneous mass, the action of the sun upon it will be distributed through the mass, and the tendency of the surface to expand more on account of its greater increase in temperature will be restrained by the cohesion of the mass so that, instead of an actual expansion of the surface to the full extent of the rise in temperature, there will be a stress in the particles of the mass, so that the actual expansion will be a compromise between that due to the great rise in temperature of the surface and the less amount due to the less rise within the mass.

If the pavement is not thoroughly bonded this stress will at times be great enough to cause a separation of the particles whose adhesion is not great enough to withstand it. A top can not be thoroughly bonded with a concrete bed which has had time to set thoroughly. Therefore, when the stress comes, the separation takes place, and the top, being free from the concrete, can take all the expansion due to greater rise in tem perature of the top. If the base had all set, the top separates from it and slips. If part of the base joined thoroughly with the top, and part of it did not, the top may rise in spots by a sort of buckling action, and one walking over it hears a hollow sound, cracks will form sooner or later, and the top will disintegrate. In cases of excessive temperature the cohesive force may be overcome suddenly and the top be forced up in a sort of explosion. This took place in some blocks of pavement in front of the Congressional

Library at Washington, there being a loud report and fragments being thrown to a considerable height and distance.

It might be possible to anchor the top at intervals by bolts, leaving expansion joints, but it then lacks the weight, thickness and stability necessary to keep it from breaking up under the shocks of traffic. The only fully satisfactory method is to secure complete bond of bed and top by laying them at the same operation and in the manner to make the adhesion of particles uniform throughout.

The reason for failure of walks made with different cements in bed and in top may be here. A difference in chemical action may reduce the adhesion of particles along the surface between the two. It has been suggested that a difference in coefficient of expansion of the two cements may have this effect.

EXPANSION OF VITRIFIED CLAY PIPE.

Can you give me the relative coefficients of expansion and contraction of vitrified clay pipe as compared with that of cast-iron?

Union Sewer Pipe Co.,
Red Wing, Minn.

We have been unable to find that any experiments on this point have been made. Can our readers refer us to any sources of information?

LINING IRON TANK CARS WITH CEMENT.

We are about to make some experiments in lining iron water tanks with cement for carrying pure water on tank cars. Can you give us any information as to methods and proportions of the mortar to be used? *J. E. Patterson & Co.,*
Pittston, Pa.

A mortar made of clean, sharp sand, not too coarse, and the best Portland cement, in equal parts, seems to give the best satisfaction as plastering. As water is to be carried, no lime should be used in this case. If the cylindrical tanks were on end while the plastering was in progress, the mortar could be applied with a trowel as in cistern lining. It may be found necessary to support the arch by some sort of centering until it is set, if the tank is lined while in place on its car. In this case the centering should he covered with metal or kept wet enough so that it will not absorb moisture from the mortar.

Two forces will tend to crack the cement lining of such tanks: the shocks it will receive while in transit, and the changes in temperature. Although iron and cement have nearly the same coefficient of expansion, the heat of the sun on the iron outside, and the water on the inside, would give the iron and the mortar different temperatures. For this reason too close a union of the cement and iron in the upper half of the tank is undesirable.

Can any of our readers give any experiences which will throw light on the question?

MANUFACTURERS OF CEMENT CONDUITS AND PIPES.

Can you give us the addresses of concerns making cement conduits, pipes, and other cement specialties?

The Art Portland Cement Co.,
Sandusky, Ohio.

The list of contractors and other large users of cement, in the "Directory of American Cement Industries and Handbook for Cement Users" ($5), gives the names of a number of such manufacturers. There are many new factories being established and the publishers will be pleased to receive information for the next edition of the book concerning any recently put in operation, or now under construction.

SMALL CITIES HAVING SEWER SYSTEMS.

Please give the names of some cities of about 7,000 population who have installed sewer systems and have reports of the same. What books on designing, construction and maintenance of sewerage systems would be adaptable? What would they cost, and where can they be obtained?

L. C. Hall, City Engineer,
Canon City, Colo.

In New York may be mentioned Albion, Batavia, Cortland, Herkimer, Tonawanda; in Ohio, Bucyrus, Defiance, Fostoria, Fremont, Lorain, Salem, Warren; in Indiana, Crawfordsville, Frankfort, Huntington; in Illinois, Canton, Champaign, Lincoln, Monmouth, Urbana; in Iowa, Boone, Iowa City; in Kansas, Ottawa, Parsons; in Colorado, Boulder, Leadville, Trinidad. For books, and cost of them, see another column of this department. MUNICIPAL ENGINEERING COMPANY will supply any books desired at the prices named.

MUNICIPAL MATTERS IN COURT.

[Prepared for MUNICIPAL ENGINEERING MAGAZINE by Andrews & Murdoch.]

Duty on Acceptance of Street—A city, having accepted and improved a street, assumed the duty of maintaining it throughout its breadth in a reasonably safe condition for travel. City of Maysville vs. Guilfoyle, 62 S. W. Rep. (Ky.) 493.

Scale in Street—Evidence that the road supervisor authorized defendant to erect scales in a street is not admissible in an action for injuries received because of such scales, since the road supervisor had no authority to grant such right. Rupp vs. Howard, 86 N. W. Rep. (Iowa) 38.

Maps of Streets—Where the newly laid out streets were traced on the maps filed in one color, and the discontinued streets in another, it was a substantial compliance with Laws 1895, c. 1,006, sec. 2, requiring the discontinued streets to be omitted from the maps. In re-Mayor, etc., of City of New York, 60 N. E. Rep. (N. Y.) 180.

Preference to Laborers—Under Laws 1898, c. 169, laborers for daily or weekly wages on public improvements have preference over all other lienors, without reference to time of filing notices of their lien. McDonald vs. Village of Ballston Spa et al., 70 N. Y. Supp, 279.

Width of Sidewalks—A general ordinance prescribing a certain width of the sidewalk in avenues of a certain width is modified by a subsequent special ordinance making a different disposition of a particularly named avenue. Budd et al. vs. Camden Horse R. Co. et al., 48 At. Rep. (N. J.) 1,028.

Trolley Line on Streets—A trolley railway track, laid in accordance with the direction of the special ordinance, will not be enjoined from operation because its location works inconvenience and injury to the abutting owners. Budd et al. vs. Camden R. Co. et al., 48 At. Rep. (N. J.) 1,028.

Diligence Required of Pedestrians—The law does not require a pedestrian to look for defects in a sidewalk, but, in the absence of knowledge of its dangerous condition, he has the right to assume that it is reasonably safe for traveling. Perrette vs. City of Kansas City, 62 S. W. Rep. (Mo.) 448.

Location of Hack Stands—A city ordinance establishing a hack stand at a depot at a greater distance therefrom than the place at which street cars are permitted to stop is not a discrimination, and hence does not render the ordinance void. Ex parte Vance, 62 S. W. Rep. (Tex.) 568.

Superiority of Street Car at Crossing—A street car has a right at a crossing superior to that of an ordinary traveler, and a person attempting to cross a track is guilty of contributory negligence in failing to look and listen for an approaching car. Stafford vs. Chippewa Valley Electric railway company, 85 N. W. Rep. (Wis.) 1036.

Assessment According to Frontage—An assessment of the cost of paving upon abutting property in proportion to the frontage of such property, when authorized by the city charter and ordinances, is not in violation of the constitution of the United States. Cass Farm company et al. vs. City of Detroit et al., 21 Sup. Ct. Rep. (U. S.) 644.

Coal Hole in Walk—Where a coal hole in the sidewalk had been propped partly open for several months to ventilate the space beneath, and plaintiff was injured by falling into it, the evidence was sufficient to support a verdict finding the city guilty of negligence. Stege vs. City of Milwaukee, 85 N. W. Rep. (Wis.) 161.

Construction and Repair of Sewers—Where a city failed to use reasonable care in constructing a sewer according to plans and specifications and failed to keep it in repair thereafter, whereby plaintiff's property and goods stored therein were damaged, and her health injured, the city was liable. Munn vs. City of Hudson, 70 N. Y. Supp. 525.

Guarding Ditch in Street—Where an adjoining property owner dug a trench in a street, the duty of guarding the same rested primarily on him, and not on the city, and the latter was not chargeable with negligence till after the due notice of the owner's neglect to light and guard such trench. Blakeslee vs. City of Geneva, 69 N. Y. Supp. 1122.

Negligence Shown by General Condition of Walk—Where plaintiff is injured by falling on a defective sidewalk, evidence of other holes and defects in the sidewalk in the vicinity of the hole which caused the fall, is competent on the question of notice to the city of the defective condition of the walk. Laurie et al. vs. City of Ballard, 64 Pac. Rep. (Wash.) 906.

Assessment for Street Improvements—Where a common council has regularly assessed property for street improvements, and given notice to property owners to file objections to the assessment within a certain time, as required by statute, an owner who fails to so object cannot thereafter collaterally attack the validity of the assessment. McNamee vs. City of Tacoma, 64 Pac. Rep. (Wash.) 791.

Water for Fountains—No appropriation having been made by the city council of the city of Detroit, for the use of the park board, to pay for water for the operation of drinking fountains, hydrants, etc., the Detroit water works was not entitled to recover from the park board for water so furnished. Board of Water Com'rs of City of Detroit vs. Commissioners of Parks and Boulevards, 85 N. W. Rep. (Mich.) 1132.

Amount of Damages for Injury to Horse—Where a city was liable for injuries to a horse by falling into an open ditch in the highway, the measure of damages was the

difference in value of the horse before the injury and after he was cured, and, in addition thereto, the cost of care and medicine in restoring the horse. Overpeck et al. vs. City of Rapid City, 85 N W. Rep. (S. D.) 990.

Uses of Highways—A municipal corporation which is empowered by its charter to regulate its streets and to prescribe the manner of their use by any person or corporation, has exclusive power to determine in the first instance how the space within the bounds of the highway shall be appropriated to the varied uses of the highway. Budd et al. vs. Camden Horse R. Co. et al., 48 At. Rep. (N. J.) 1028.

Use of Street Adjacent to Freight Depot—The appropriation, whether by custom or ordinance, of a street adjacent to a railroad freight house to the use of teams, trucks and wagons in loading and unloading merchandise, is a legitimate public use of the street, of such importance that a mere trespasser, seeking to interfere therewith, should receive scant favor from a court of conscience. General Electric Ry. Co. vs. Chicago, I. & L. Ry. Co., 107 Fed. Rep. (U. S.) 771.

Traction Engines on Streets—Burns's Rev. St. 1894, No. 3,541, giving a city power to regulate by ordinance the use of coaches, hacks, drays and other vehicles for the transportation of passengers and freight or other articles for hire, gives no authority to prohibit the running of traction engines on the streets, but is limited to a regulation of vehicles in use. Bogue et al. vs. Bennett, 60 N. E. Rep. (Ind.) 143.

Negligence of Workmen—Though a city is not liable for negligence in the construction of highways in the manner prescribed by general law, it is responsible for the negligence of its workmen in the construction of a highway, where the same is built under the direction of the city officers, and not those designated by general law to have charge of such improvements. Butman vs. City of Newton, 60 N. E. Rep. (Mass.) 401.

Depression in Street—Where, in action for injuries received by stepping into a depression in the street on alighting from a street car at a crossing which was much used, the undisputed evidence showed that the depression into which plaintiff stepped was not more than an inch and a half deep at any place, it did not constitute an actionable defect for which the city was liable. Burroughs vs. City of Milwaukee, [illegible] N. W. Rep. (Wis.) 159.

Street Car Company's Liability on Acquired Franchise—Where a street car franchise requires the company to acquire the franchise of a former company, which contained regulations as to the manner of operating the cars, but does not refer to such old requirements or make the provisions of the old grant part of the new one the new franchise is not subject to the old conditions and regulations. Stafford vs. Chippewa Val. Electric R. Co., 85 N. W. Rep. (Wis.), 1,036.

Escaping Sewage—A city charged with allowing escape of sewage from its sewer farm into a water course to the damage of a lower riparian owner cannot set up as a defense that its sewer farm had been leased and that it was owing to the negligence of the lessee that the injury resulted, and in an action for such injuries the effect of the sewage on lands beyond plaintiff's property may be shown. City of San Antonio vs. Diaz, 62 S. W. Rep. (Tex), 549.

Abandonment of Highway—Where the owner of land through which a highway passed agreed with the board of aldermen that they would claim no damages by reason of its abandonment and petitioned the board therefor, whereupon the board exercised the power of abandonment according to the prescribed statutory rules, the general public had no standing in court to complain of such abandonment. Attorney-General ex rel., Trustees of Mathewson St. M. E. Church et al. vs. Shepard et al. (R. I.), 39.

Power Over Dedicated Street—A deed conveying land for a street to a city "to have and to hold * * * to the same extent and with the same effect as if the said street had been opened by a decree * * * on proceedings had for that purpose under the road laws of the commonwealth," gives the city the same power over the street, including the narrowing or vacating of it, as though it had been opened by adverse legal proceedings. Morris vs. City of Philadelphia et al., 49 At. Rep. (Pa.), 70.

Erection of Buildings—Where a contract for a school building provided that the superintendent of school buildings should decide all disputes concerning the execution of the contract, and that his decision should be final, in the absence of fraud or palpable mistake, the superintendent's decision that the plaintiffs were not proceeding with the work in the manner prescribed by the contract was conclusive on the parties. Jones et al. vs. City of New York et al., N. Y. Supp., 46.

Burial in City Limits—Under a city charter authorizing a city to provide for the health, cleanliness, peace and good order of the city, and to prevent and remove nuisances, an ordinance prohibiting burials in certain territory of the city, distant more than half a mile from any inhabitants or public thoroughfare, being unreasonable, as applied to sparsely-inhabited portions of the city, and general in its operation, is invalid as to the whole and falls in its entirety. Wygant vs. McLaughlan, 64 Pac. Rep. (Or.) 867.

Restrictions on Hack Drivers—Provisions in the city ordinance establishing a hack stand which locate such stand across a thoroughfare from a city railroad station, and at a distance of fifty feet from the sidewalk in front thereof, and which requires the drivers to stay with their vehicles, and forbid them leaving such vehicles to solicit passengers or to assist customers to the vehicles, and which prohibit runners therefor on the thoroughfare or sidewalk, do not render the ordinance void for unreasonableness. Ex parte Vance, 62 S. W. Rep. (Tex.) 568.

Variance of Contract and Plan—A city entered into a contract for the laying out of a street between certain points and the grading thereof as provided for by a city ordinance and by the advertised proposals for bids; the work to be done in accordance with the specifications and a plan of work, showing the grade lines and profile. Held, that the fact that only a portion of the whole length of the new street was shown by the plan does not limit the work to that portion, and in case of a discrepancy between the plan and the contract the contract will control. Dean vs. Mayor, etc., of City of New York, 60 N. E. Rep. (N. Y.) 236.

Work Overtime—Where over 300 drivers in the street cleaning department testified that they expected and were told that they would receive pay for work done overtime, and the then heads of such department testified that they deemed it necessary to work such drivers overtime each day, and that the drivers were entitled to pay for such overtime, and were not paid because of lack of appropriation, the evidence sustained a referee's finding that such services were rendered under circumstances authorizing an expectation of compensation for overtime, rendering the city liable for such services, notwithstanding payment therefor was not expressly provided in the contract of employment. McNulty vs. City of New York, 70 N. Y. Supp. 133.

Construction of Sewer Along Railways—Plaintiff agreed that he would furnish the necessary facilities to preserve a railroad track on the line of a sewer from injury, either by removal or otherwise, without extra charge, and the park commissioners agreed that, in case it should be necessary to remove the tracks, they would notify the company to do so. Work was commenced on the sewer Sept. 29, 1884, and, removal not being necessary, the city engineer notified the company to protect its tracks. The piles at the bottom of the trench for the support of the sewer were driven beneath the tracks by the railroad company at intervals between trains, and it left its machinery on a side track, in plaintiff's way. Held, that the city was not liable for an alleged negligent and dilatory performance since the only duty imposed on the city was to notify the company in case removal was necessary, and any delay occasioned by the company could not be charged to the city. Jones vs. Mayor, etc., of City of New York, 70 N. Y. Supp. 296.

Engineer's Direction as to Work—Plaintiff agreed that the city engineer's decision that piles were necessary for the foundation of a sewer to be built by plaintiff should be final. On June 28, 1887, plaintiff notified the board that piles were necessary at certain places, and requested a speedy reply. The enginer answered on June 30, notifying plaintiff to construct the sewer at such points without piles, and on November 19 further notified plaintiff to proceed without driving piles, and that the engineer had examined the trench and found that piles were not necessary. On December 25 certain property-owners presented an opinion of an expert engineer that piles were necessary at such points. Plaintiff refused to continue the work, and finally the park commissioners yielded to the demand of the property-owners and authorized the use of piles. Held, that plaintiff was not entitled to damages for a delay alleged to have been occasioned by the refusal of the engineer to give his permission to drive piles, since the engineer's decision that piles were not necessary was final, and plaintiff had refused to abide by it. Jones vs. Mayor, etc., of City of New York, 70 N. Y. Supp. 296.

PURIFICATION OF THE CHEMUNG RIVER AT ELMIRA, N. Y.*

By James M. Caird, Elmira, N. Y.

The Chemung river is formed by the uniting of the Tioga and Cohocton rivers nineteen miles above Elmira. The Chemung river is about fifty miles in length and flows into the north branch of the Susquehanna.

The Tioga river rises in the coal district of Pennsylvania and has an average descent of seventeen feet per mile.

The Cohocton river has only a slight descent.

The slope of the Chemung river from Painted Post to Elmira is at the rate of 5.9 feet per mile; it then flows through the city of Elmira for three miles at the rate of 3.5 feet per mile.

The river is subject to severe floods; at times the water rises eighteen feet.

The area drained above Elmira by the Chemung river and its tributaries is about 2,056 square miles.

*A paper before the American Water-Works Association, June, 1901.

On examining the polluting territory of the river for a distance of fifty miles above Elmira there will be found to be over 50,000 people in cities and villages and over 15,000 people having direct sewage connections with the river.

The water always has a marked turbidity and carries heavy suspended matter.

The water for filtration at Elmira is taken from the river through a crib which is connected with a gallery; from thence it flows to the pumps.

The pumping station is equipped with two Worthington High Duty pumping engines of six and ten-million gallons daily capacity. Only one of these pumps is used at any time.

The water is forced through a twenty-inch main to the filter plant, which is about two miles north of the pumping station.

The pumps lift the water 118 feet for delivery.

The filter plant, which is of the American or mechanical type, consists of eighteen Jewell subsidence gravity filters, 13½ feet diameter, outside measurement.

Each filter has an effective surface of 113 sq. ft., or a total of 2,034 sq. ft., which is equal to about 1.21 of an acre. The filters have been operated at the rate of 157,000,000 gallons per acre per day; thereby filtering over 7,500,000 gallons daily.

The process of filtration is as follows:

The water to be filtered is treated with a solution of sulphate of alumina; this being done by gravity. The analysis of the sulphate of alumina shows it to contain: H2 O, (water) 43.1 per cent., S O3 (sulphuric acid) 38.4 per cent., Al2 O3 (available alumina) 17.5 per cent., insolubles 0.3 per cent., Fe. (oxide of iron) trace.

The alumina is dissolved in two tanks having a capacity of 1,700 gallons each.

From the dissolving tanks the solution is pumped to the distributing tank, which is at the top of the filter building; from this it flows by gravity to the supply main, entering it about thirty feet outside of the filter building.

The amount of solution which leaves the distributing tank is governed by weir rings.

The distributing tank is also equipped with a large overflow pipe which discharges into the dissolving tank. The distributing tank is always overflowing. The overflow is used to keep the solution in the dissolving tank thoroughly mixed.

Repeated tests show that the Sp. gr. of the alumina solution is the same at the top and the bottom of the dissolving tanks.

The solution of sulphate of alumina is prepared by weight, the proportion being one part of alumina to twenty parts of water.

After treatment with the solution of sulphate of alumina the water passes to the subsidence basins, where it has about thirty minutes subsidence.

The water then passes to the top of the sand and after passing through the sand it is discharged into a flume which conducts it to the filtered water or distributing reservoir.

The sand bed is about 48 inches in depth. The sand used comes from Red Wing, Minn., and is almost pure silica, the grains being nearly uniform in size and shape.

The mechanical analysis shows the sand to have an effective size of .56 mm. and a uniformity coefficient of 1.43.

Use is made of the water in the flume (on its way to the distributing reservoir) to turn a water wheel, which operates two pumps; one of these pumps raw and the other filtered water, through the observation tubes.

The observation tubes are on the operating floor and consist of two glass tubes 4 inches diameter and 5 ft. 4 in. long.

The operator, by looking at these tubes, can readily learn what is being acomplished by the filters.

It is to be noted that if the removal of the turbidity is complete the bacterial efficiency will be satisfactory.

Several bacteriological tests have been made at the filter plant since June, 1898.

A test of the subsidence basin (60 samples being taken) showed that it removed from 30.2 per cent. to 89.4 per cent. of the bacteria. The average being 69.8 per cent.

This represents the deposit from seven days' operation.

The filtered water reservoir is uncovered.

The general efficiencies of the filters, by months, follow:

Date.	Bacteria per c. c.		Per cent. reduction.	Alum grs. per gal.	Rate per acre per day.
	Influent.	Effluent.			
June, 1898	2500	101	95.08	.45	99,000,000
July, 1898.....	3046	84	97.26	.53	91,000,000
Aug., 1898	1166	45	96.19	.51	97,800,000
Feb., 1899	4000	182	95.38	.47	66,200,000
Mar., 1899	7338	150	98.10	.96	83,000,000
Oct., 1899	1074	27	97.48	.81	94,000,000
Nov., 1899	11900	118	99.02	2.89	105,000,000
Mar., 1900	35580	97	99.82	3.16	73,000,000
Aug., 1900	578	20	96.47	.72	94,000,000
Sept., 1900 ...	516	14	97.18	1.35	98,000,000
May, 1901	1848	23	98.43	1.38	107,000,000
Average	6322	76	97.31	1.20	91,690,000

Before March, 1899, the aluminum solution was pumped directly into the main supply. This method proved to be very unsatisfactory as the fluctations were too large.

With this new method of feeding, the coagulant is applied with great uniformity.

Disregarding the results obtained be-

fore March, 1899, we have the following efficiency:

Date.	Bacteria per c. c.		Per cent. reduction.	Alum grs. per gal.	Rate per acre per day.
	Influent.	Effluent.			
Mar., 1899	7338	150	98.10	.96	83,000,000
Oct., 1899	1074	27	97.48	.81	94,000,000
Nov., 1899	11900	118	99.02	2.89	105,000,000
Mar., 1900	33580	79	99.82	3.16	73,000,000
Aug., 1900	578	20	96.47	.72	94,000,000
Sept., 1900 ...	516	14	97.18	1.35	98,000,000
May, 1901	1848	23	98.43	1.38	107,000,000
Average	8392	60	98.07	1.61	93,470,000

These results present the efficiency of the filter plant in its present or perfected condition.

There has never been any free alumina in the effluent, the alkalinity in flood time being sufficient to decompose five grains of coagulent to the gallon.

The bacillus coli communis has always been found in the river water.

During the test made March, 1900, the influent was examined four times and the bacillus coli communis was found in all samples.

The effluent was examined six times with negative results.

Two c. c. of the influent and fifty c. c. of the effluent were used for each test.

The general efficiency of this test follows:

Bacteria per c. c.....Raw 35,580
Bacteria per c. c.....Filtrate 79
Per cent. redt.. ....99.82
Alum grs. per gal... .. .. 3½
Rate of filtration..... 73,000,000

The tests for the bacillus coli communis used were:

Gas, about 50 per cent. Acidity of bulb. Ratio of H. to Co. "Indol" reaction. Reduction of nitrates to nitrites. Motility. Colony non-liquefying.

The quantitative bacterial methods of examinations were as follows:

Culture media—nutrient gelatin was used —1 lb. beef, 100 gms. gelatin, 10 gms. peptone, 5 gms. common salt, being used to make one litre. The reaction used was plus 15 acidity. This reaction was found to give the maximum growth.

The bacteria are cultivated from three to five days, at 20 degrees C., the time varying with the seasons.

The plating is so arranged that not more than 300 colonies are in a plate.

Beginning with the year 1895 a very careful record of the typhoid fever cases has been gathered under the direction of Dr. H. D. Wey, health officer.

Under the law, physicians are required to report cases of typhoid fever to the health officer; a violation of this law is punishable by a fine.

As soon as a case is reported an official from the health department visits the case, making a sanitary inspection of the premises; he also takes notes in regard to the sources from whence the water and milk are obtained.

The population of Elmira is about 35,000; it is estimated that 20,000 use the filtered water, which leaves it 15,000 having wells for their supply.

The total number of cases of typhoid fever in Elmira for three years before the the filters were put in operation was 629; total number of cases during three years' operation of the filters was 284; this makes a reduction of 60 per cent. in the total number of cases.

The cases by years and the water they used are as follows:

TYPHOID CASES BEFORE FILTERS WERE IN OPERATION.

Date.	Total Cases.	Using City Water.	Using Well Water.	Imported.
1895	107	21	27	59
1896	439	287	123	29
1897	83	43	32	8
Totals	629	351	182	96

TYPHOID CASES AFTER FILTERS WERE IN OPERATION.

Date.	Total Cases.	Using City Water.	Using Well Water.	Imported.
1898	76	38	35	3
1899	75	29	45	1
1900	97	42	47	8
Totals.	248	109	127	12
Difference.	381	242	55	84

From the above figures it is seen that there has been a reduction of over 68 per cent. in the cases of typhoid fever among the users of filtered water.

There has been a reduction of only 30 per cent in the cases of typhoid fever among the users of well water.

During the last three years there have been 109 cases of typhoid fever among the 20,000 users of filtered water; while during the same period there has been 127 cases of typhoid fever among the 15,000 users of well water.

It would seem that the greater number of cases of typhoid fever was among the users of well water.

The results obtained from the purification of the Chemung river at Elmira, N. Y., are most gratifying.

REQUIREMENTS OF BRICK FOR PAVING PURPOSES.*

By H. E. Beasley, City Engineer, Peoria, Ill.

I think that I am perfectly secure when I state that a brick pavement constructed of A No. 1 paving brick on a concrete foundation, with the proper sand cushion between surface and foundation, is as good a pavement for a residence or business street as can be secured.

In the construction of such an improvement everything moves pleasantly and generally without any friction whatsoever, until the contractor prepares to lay the brick. Then come the discussions and arguments of the contractor and the manufacturer on the one side, with the city engineer, backed up by the improvement board, on the other.

The contract and specifications are produced and the articles relating to the requirements of brick are read and commented upon.

In many instances the engineer, in drawing up the specifications, will refer to similar ones obtained from various cities and insert the good points of each in his own.

The specifications state that the absorption shall not be more than so much, the loss by abrasion shall be so much, and the transverse test shall indicate so much.

The above mentioned engineer will not, in nine cases out of ten, have the various machines at hand to test the material; then comes a renewal of the arguments. Why cannot the absorption test be modified? And in turn the same is asked for each of the other requirements. The result is that each give and take. Perhaps the pavement will stand for a number of years. The manufacturer is pleased. Perhaps the opposite; the property owner is displeased; the engineer seeks another position.

In a number of larger cities the engineer has at hand the machinery to make the tests. Then he shows to the contractor and manufacturer the results, and informs them that the specification must be lived up to. He has prepared his specifications from tests made in previous years, and knows that material that will fulfill the requirements will make an excellent paving material.

The following is quoted from the specifications for brick pavements as was used in the city of Peoria in the year 1900:

The size of the bricks shall be two and one-half (2½) inches by four (4) inches by eight (8) inches, or three (3) inches by four (4) inches by nine (9) inches. They shall be straight, regular in size and shape, and free from flaws, cracks or breaks. They shall be made expressly for paving and shall be hard, tough and thoroughly vitrified, and must fulfill the following requirements:

The modulus of rupture for transverse strength must not be less than 2,200 pounds per square inch, computed by the formula

$$R = (3l - 2bd^2)w,$$

where R is modulus of rupture per square inch, l, length between supports in inches, b, breadth in inches, d, depth in inches and w, load in pounds. Bricks to be tested flatwise.

They shall not absorb more than two (2) per cent. of their own weight in water after being immersed for forty-eight (48) hours.

The abrasion test shall be made by placing not more than twelve (12) bricks in an iron rattler twenty-eight (28) inches in diameter and three (3) feet long, together with four hundred and fifty (450) pounds of smoothly worn scrap iron, the pieces of which vary in weight from one-fourth of a pound to four (4) pounds. The rattler will then revolve one (1) hour at the rate of thirty (30) revolutions per minute. The loss in weight at the end of the hour for the 2½x4x8-inch bricks shall not exceed fifteen (15) per cent. and for the 3x4x9-inch bricks shall not exceed thirteen (13) per cent.

The bricks shall not contain lime in such quantity as to cause disintegration or cracking after ten (10) days' immersion in water, delivered on the streets from samples selected at large by the engineer.

No broken or poorly shaped bricks shall be used in the pavement, except at the end of the courses, where half-bricks may be used to break joints.

The intention of the above requirements is to procure for the work the best paving bricks obtainable in the market.

These specifications were prepared after a careful study of the tests of materials used in previous years, together with a careful study of pavements laid.

You will note the following expression in the first paragraph of the requirements: "And shall be hard, tough and thoroughly vitrified." I fail to see how any clay or shale can be tough and thoroughly vitrified at the same time.

"Vitrified—Converted into glass; hence, by extension, partially converted into glass, as having the exterior converted into a glaze or having the substance hard and glassy from exposure to heat." What is intended by this phrase is tough and thoroughly annealed. "To treat by heating and gradually cooling, so as to toughen them and remove their brittleness."

The limit of absorption is placed at two (2) per cent. The question then arises, shall any distinction be made between brick that

*A paper before the Illinois Clay Workers' Convention.

have been repressed and those not repressed.

Repressing makes the mass more solid and excludes to a great degree any laminations that may be in the green brick. It is a question whether or not a brick by repressing does not lose some of its good qualities.

It is a hard matter to place the limit of absorption at such a point as will be fair to both sides.

The writer knows of a certain piece of work wherein brick were used that will absorb a greater amount than two (2) per cent., and the pavement is today, after four years of heavy wear, in excellent condition. It does not follow, however, that all brick of as great a per cent. of absorption will make as good a pavement as this particular one. You often hear the statement that soft brick will be damaged by freezing. A brick of that nature is too poor to be used in any building, not to mention a pavement.

The writer is familiar with a number of improvements wherein brick were used in which the absorption is even 5 per cent., and does not notice any serious results from the use of such so-called soft brick. Another street which I can call to mind is one in which one side is paved with brick wherein the absorption will be as high as 7 per cent.; the other side is paved with brick of an entirely different method of manufacture, and the per cent. of absorption is below 2 per cent.

An examination of this particular case after a year's wear will, I have no doubt, be very entertaining and perhaps upset some of the theories now advanced concerning the different methods of paving brick manufacturing.

The abrasion test is one in which the results obtained do not always signify that the best-wearing brick gives the best result in a pavement, as the writer can recall an instance in which the brick after a year's wear showed signs of considerable wear. This brick stood the test exceptionally well; the amount of absorption was low, the loss by abrasion low and the transverse test high, and one would naturally expect the best result in a pavement.

So you can see, gentlemen, that the engineer in writing his requirements for brick, while he seeks to obtain the best in the market, does not always get it. He tries not to work any hardship upon the manufacturer, but rather to help educate him as to what must be placed on the market.

Manufacturer and engineer will welcome that day when all specifications will read alike. It will save both considerable trouble and perhaps hard feeling that may exist at present.

The art of manufacturing paving brick is new as yet, and I have no doubt that in the course of a few years we shall arrive at the point where we all are satisfied, each company will place upon the market as good a paving material as any other and every brick will be tough, hard and thoroughly annealed.

WATER DISTRIBUTION.*

By Charles A. Hague, M. Am. Soc. C. E.

There has been so much said about purifying the water supplies and measuring them that I thought there was room for some remarks upon the subject of distributing water to the people; and, by the way, I notice that the meter people are getting pretty friendly with these water purifiers, for the reason that they know well enough, in view of the large amount of money spent upon water purification, that it must be measured when delivered to the consumer, so that I suppose that will be one of the coming problems.

The next thing to the obtaining of a good and adequate water supply and bringing it to town, or storing where it will become available, and one of the greatest importance, is to arrange the distribution, that the delivery of the water at the different points of consumption shall be accomplished with the least possible loss of head or pressure. The variety of conditions is so great that it is impossible to lay down even a general rule beyond the demand for the maintenance of a proper pressure, as the distribution would be materially different in each case. If the water all came from one point, as from a reservoir or from a pumping station, then, of course, the main pipe leading into a system would need to be of a capacity which would be equal to the combined demand under the varying conditions of all the pipes or mains leading to the different districts supplied. This does not mean that the principal main must be of an area which shall be equal to the sum of the areas of all the distributing pipes,

*From a paper before the American Water Works Association.

because the variation of the areas and the friction of the water due to pipe length are controlling factors; each item must be considered by itself, and so, if the entire supply is carried by a single large pipe to a certain point where it really joins the distribution, the delivery of the entire quantity of water at this point by main pipe must be considered by itself, and the size of this main, length of same, etc., must be determined with reference to the pressure wanted at this point of juncture with the system when the flow of the full quantity is going on. Probably the best way to arrive at reasonable ideas as regards the proportioning and arranging of a water pipe system is to divide the city into districts and carefully gauge the amounts of water wanted by classifying the houses, buildings, factories, etc., which can be done with great accuracy and precision. This would apply to the planning of a new plant as well as the remodeling of the one already in existence. And having thus mapped out the city, defined its districts, and determined the quantity of water needed in each, the diameters, lengths and locations of the pipes through which it must flow may be arranged with certainty and economy, so that the desired pressures may be maintained, and other details studied out. Each case must be treated differently and according to the general form of the town, the relative position of the supply, the locations and extent of the residence districts, the manufacturing districts, points where unusual fire protection may be required, such as lumber yards and the like. But it is possible to determine and locate upon a map of the city these several districts and then the diameters of the water mains necessary to deliver with certainty the ascertained quantities of water can be arrived at without much trouble.

Although mature judgment based upon experience and observation may go a long way in determining and arranging a water pipe system, and the system needed be projected by a study of a city, a recording gauge placed a various points at different times and its indications noted will be found to be of valuable service in ascertaining the easiest and most economical plan for distributing the water under the most advisable pressure and in the necessary quantities. Thousands of dollars have been lost in fires, which might have been saved by a more intimate knowledge of the restrictions existing in water pipes—a state of facts which could have been readily and unerringly revealed by the inexpensive application of a recording gauge. The repeated and insistent reports and complaints of fire departments, where they have been restricted in usefulness by lack of water time and time again, until some general conflagration involving the loss of lives and property occurs, finally lead to a knowledge of inadequate pipes, which the proper attention at an earlier day would certainly have pointed out. As has often been shown in cases wherein a shortage of water, reduction of pressure, and consequent losses have occurred, these troubles have been caused by mistakes in planning or in a failure to keep the system up to growing demands. Mains in neighborhood streets should be connected, wherever possible, at crossing streets, so as to avoid abnormal draughts of water through long lines of pipe—such conections affording supplies in case of need from all directions and also avoiding dead ends in the system. One fruitful source of trouble and losses is in the use of too much of the smaller sizes of water pipes—the idea, of course, being to keep the cost of the plant down to the lowest practical figures; but such a practice is based upon mistaken economy, as the cost of pumping or the loss of pressure produces a balance upon the wrong side of the account; and this burden goes on continually. A minimum internal diameter of six inches would be a good rule for the owner of a water works plant to adopt, and eight inches would be in most cases better still in these days of cheap pipe maunfacturing.

There are no doubt a good many cities in which the water pipe systems are well enough laid out at the beginning, but which have grown completely away from the original plants; partly, from the original increase in population and business along regular and anticipated lines, and partly, from the fact that cities, especially American cities, are not infrequently prone to grow in unforeseen directions not contemplated by the projectors of the water supply plant; and then, of course, after the lapse of a few years, the water pipe system, even though designed at first never so wisely, would need to be revised to meet the changed conditions. During the past thirty years or so many water works systems have been devised and built in various parts of the country, which were probably adequate enough as the needs of the future were regarded at the time of the building; but the enormous development of cities and towns during the period has entirely upset all rational ideas held by people thirty years ago. The results are, that, in a good many municipalities, the pipe systems are entirely out of proportion to the wants of the distribution; they need a thorough re-arrangement; and at least ought to be considered with reference to a consistent plan, so that whatever is done in the way of repairs and renewals, extensions, etc., may be done in the line of direct capacity regarding the future, as judged in the view

of a more comprehensive grasp of the subject.

The infancy of the water works problem is long passed, and a much stronger and clearer light envelopes the question today than was possible a quarter of a century ago. Competition, sharp and strong, has brought the details of water works construction up to a finish and completeness far beyond any ideas entertained a few years past, so that, not only is the cost greatly reduced, but the facilities and appliances are brought out, and thought out, and adapted to a point and in a manner actually reaching to the dignity of a science.

In changing or replacing water mains in streets, various difficulties are to be met with, some rather serious, but none insurmountable, although patience, courage and firmness are often required to a high degree in the face of obstacles presented by sewers, gas mains, etc. The planking and bracing of the sides of the trenches will be found necessary in many cases and in many locations where mains are to be laid through streets already occupied. But a thorough examination of the situation will indicate what must be done, and even though the work may at times resemble in general characteristics a sugical operation upon an extensive scale, a carefully thought out plan, closely adhered to, will carry us through to successful completion.

CURRENT INFORMATION

A Decision in the Peoria Electrolysis Case.

The report of Frank L. Wean, special master in chancery, in the Peoria electrolysis case, was filed with the clerk of the United States circuit court in Chicago, May 29. The suit was begun by the Peoria Water Works company, over three years ago, to restrain the local electric railway company from operating their lines without the employment of double overhead wires. The findings of Special Master Wean are a complete victory for the water company, and, if approved on final hearing by Judge Grosscup, two street railway companies will be restrained from operating their cars by this system and will be compelled to substitute a double trolley system for the return circuit without using the earth as a medium. Special Master Wean holds that the underground water mains in Peoria are decomposing under the influence of the electricity, which escapes from the trolley lines; that the damages done by electrolysis is chargeable to the defendants, and recommends that an injunction be issued subject to reasonable conditions imposed by the court.

The report must come before Judge Grosscup on a final hearing. If the report is finally upheld it will result in the introduction of important changes on most of the electric railways of the United States, for the single trolley is in general use in most of the cities. Suits for damages resulting from electrolysis have been held up in several cities pending a settlement of the Peoria case. Since the appointment of Mr. Wean as special master on May 26, 1898, evidence has been taken at Peoria, Chicago, Cincinnati, New York, Brooklyn, Albany, Philadelphia, Pittsburg, Milwaukee and Terre Haute, and expert testimony has been taken from time to time on both sides of the case.

American Water Works Association Meeting.

The twenty-first annual convention of the American Water Works Association was held in New York, June 17 to 21. Officers for the ensuing year were elected as follows: President, William R. Hill; vice-presidents, C. H. Campbell, Dabney H. Maury, Charles E. Rowe, Dow R. Gwinn and G. H. Felix; secretary and treasurer, Peter Milne.

In a paper presented by George I. Bailey, Superintendent of the Bureau of Water, Albany, N. Y., he described the operation of the Albany filter plant. John C. Trautwine presented a paper presented by Nicholas Simin, Chief Engineer of Water Works at Moscow, Russia, on water purification by means of ozonized air. James M. Caird presented a paper on the purification of Chemung river at Elmira, N. Y. John M. Diven, Superintendent of Water Works at Elmira, discussed mechanical filtration at that city and elsewhere, bringing out considerable discussion. The water at Elmira is sometimes so soft that lime has to be added to it in order that the alum used as a coagulent may perform its purpose. Dow R. Gwinn of Terre Haute explained the process used by him at Quincy, Ill. The water at that place was likewise very soft; so instead of using both lime and alum,

sulphate of lime was employed, the method of its production being new. The cost of the various items entering into the expense of mechanical filtration was explained in some detail, and he stated that the total cast at Quincy was $2.80 per million gallons , inclusive of coagulent, interest charges and other expenses. P. A. Maignen presented a paper on the purification of water, describing the process of filtration he has invented, which is marked essentially by two devices. The first is a "scrubber" in which the water ascends through a series of baffle-plates and coarse obstructing materials, the purpose being to clarify the water as much as possible before it reaches the filter proper. The second feature is the use of a thin layer of asbestos fiber on the surface of the filter bed, its purpose being to provide a tough and removable substitute for the "schmutzdecke" of the usual sand filter. Clemens Herschel presented a paper on "An Attempt to Prove that Thrift in the Operation of Water Works is More Economical Than Waste." This paper was based on some statistics compiled by George I. Bailey showing that in a general way the metering of one-half or more of the service pipes in a city will reduce the average consumption of water about 50 per cent. An interesting paper was presented by Henry C. Hodgkins recording some observations on the consumption of water in his house at Syracuse. The paper describes in detail the fixtures and the periods they were in use, the extent of repairs from 1894 down to the present time, and other points useful in discussing the results. Of the total supply to the house it was found that about 15 per cent. was used for culinary and drinking purposes, 10 per cent. in the laundry, 30 per cent. for the closet flush tanks, and 45 per cent. for bathing. The greatest source of leakage was found to be the flood valves and flush tanks, which often failed to shut off the water when the tank was full. Another paper on the same subject was read by S. J. Rosamond, superintendent of water works at Ft. Smith, Ark. Among other papers presented was one by Mr. Simin on electrically driven centrifugal deep well pumps at the water works of Moscow; one on storage water supplies by L. J. LeConte, recommending greater attention to data giving the runoff of water sheds, which he considered more important than rainfall records, one on "Mattoids in Engineering," by H. E. J. Porter; one on water distribution by Charles A. Hague; one describing the distribution of the St. Louis water works by B. C. Adkins; one by George T. Latta, describing a method of utilizing water ram on the works of Ludlow, Ky., under his charge.

The report on electrolysis, presented at the last convention by Dabney H. Maury, George H. Benzenberg and J. Waldo Smith, was adopted. The report contained the following resolutions:

Resolved, That the American Water Works association, as a national organization, herewith unanimously maintains that street railways have no right to so operate their cars as to cause injury and destruction to water pipes; and, be it further

Resolved, That street railways now operting under the single trolley system ought to be required to remove their return current from the ground, and that if they continue to operate by current transmitted from the power station to motor on the cars, they should be required to provide a complete metallic circuit of sufficient capacity to convey all the current, and in a manner to absolutely insulate it from the rails and from the earth.

The discussion prior to the adoption of the resolutions was participated in by Charles E. Rowe, who reviewed the trouble which is being experienced in Dayton, O., with electrolysis; A. A. Knudson described the effect of poor bonding at railway crossings; Emil Kuichling said his experience at Rochester and elsewhere convinced him of the importance of prohibiting rail returns; Nicholas S. Hill, jr., described his experience with the electric subways in Baltimore, where he was compelled, in order to save the lead coverings of the cables, to connect them with copper wires running directly to the negative bus-bar of the electric railway switch board. Measurements showed that more than half the current of the station was returned over these cables. Mr. Hill did not think it advisable, however, to adopt resolutions prescribing specific methods of construction which alone would be acceptable to the association. He believed that large investments had been made in electric railways under the advice of the most competent specialists and no steps should be taken without careful consideration, which would jeopardize the security of these investments.

Better Bookkeeping and Operating Methods for Columbus, O., Water Works.

The special investigating committee appointed by Mayor Hinkle of Columbus, O., to report on the manner in which the water works department of that city is conducted, charges extreme looseness in the conduct of the affairs. Radical changes in the bookkeeping and manner of

collecting water rents are recommended, as great opportunity for stealing is given under the present system, with very little chance of detection. The committee believes that the water works department should pay interest on its bonds and say that more than enough for this could be secured. The committee also recommends the cutting of the free list, saving $24,000 a year; stopping wastage, $20,000; small charge for fire hydrants, $34,200; total, $78,200, which is $21,470 in excess of the interest charges. It is claimed that one-third of the water pumped is wasted, and that with care $20,000 a year could be saved in this one respect. The universal use of meters is urged, and also the abolition of the minimum water rates. Referring to meters, the committee states that there are some peculiar things regarding the purchase of meters, and later selling them to customers. No bids are asked for or received for meters, notwithstanding the fact that purchases repeatedly exceed $500. The highest market price has been paid for meters, and there is no evidence that an attempt has ever been made to get them at their lowest cash price. The committee claims that the law providing that no purchases exceeding $500 be made without first advertising has been a dead letter in the water works office for years. The committee recommends that larger bonds be required of the employes of the department, and that more latitude be given the director in making discharges of civil service employes. Also, that changes along this line be made in the operation of the civil service law. Many persons have not given water deposits as required by the department, and many have not paid for repairs made. The committee claims that under the present system the storekeeper could be misinformed and the city defrauded. The city has purchased many tons of iron pipe since 1893, yet it has depended wholly upon the honesty of the seller as to the correct weight and quality of the pipe. The report says:

> Singularly enough we were unable to discover any inventory or appraisment of the property, real or personal, belonging to the water works plant, and we are advised that no such inventory has ever been taken since its inception in 1870. Such being the case we have no means at hand of advising you of just what property it is possessed or of its present value, other than that of a single statement contained in the report of the suprintendent showing the amount of money which has from time to time been invested therein.
>
> We certainly recommend that a careful enumeration, inventory and appraisement be immediately taken, made and preserved, with a comprehensive description of all the lands, buildings and personal property belonging to the department, including mains, conduits, filtering galleries, machinery, tools, books, furniture, fixtures, etc., and that such enumeration shall be repeated each year so that an incoming director may receipt to the director retiring therefor.

W. M. English, Dudley A. Filler and R. R. Bartram compose the investigating committee.

Water Supply of Kingston, N. Y.

The regular supply of water for the city of Kingston, N. Y., is drawn from creeks in the Catskills and is impounded in reservoirs of 200,000,000, 65,000,000 and 45,000,000 gallons capacity respectively. Usually the supply is ample, but during the year 1900 the rainfall was 25 inches for 11 months, while the usual annual rainfall of the state is about 42 inches. As a consequence of this failure of rain and of the use of over 100 gallons per capita per day the storage capacity was very nearly exhausted and it was necessary to install temporary pumps to force water from Esopus creek up to the filters and thus supply the deficiency. By cutting off sprinkling by hose and other causes of extra use the drought was tided over. Superintendent O. C. Longyear recommends the attachment of meters to taps used for sprinkling and suggests the general use of meters if the supply again runs low.

Waste of Water Restrained by Order of Court.

Judge Baker of the United States court has issued an order restraining the citizens of Fowler, Ind., from wasting water. The water plant is in the hands of a receiver, Perry Stembel, who was apointed by the United States court on application of a trust company. The receiver has reported that at the hotels, livery barns, and in many private homes the people open the water hydrants and let them run day and night. The receiver stated that this was practiced to such an extent that he could not watch all the hydrants in town, and that unless something was done to correct the waste of the water supply, the plant would have to be operated both day and night. Judge Baker has directed the receiver to purchase meters and attach them to the hydrants of the larger users. Also, to shut off the water where hydrants are being wilfully left open.

Electrolysis of Water Main in Racine.

A recent investigation of the 24-in. water main in Racine, Wis., developed the fact that electrolysis has so seriously affected it near the power station of the electric railway that many lengths had to be replaced with new pipe, in order to avoid danger of breaks when the system is under fire pressure. The metal of the water mains was so softened in many other places that spikes could be easily driven into it, and it was possible to scrape off ⅜-in. or so with-

out exerting great force. The investigation was made by George H. Benzenberg of Milwaukee.

Anoka, Minn., Must Pay for Water and Light Furnished.

A decision was rendered by Judge Lochren of the United States court, June 7, Anoka Water Works, Electric Light and Power company vs. the city of Anoka, Minn., and members of the city council. The suit was the result of a contract entered into which provided that the company was to furnish the city with water and light for a period of thirty-one years. The city ordinance which authorized the council to grant the franchise and enter into a contract with the complainants was later repealed for the purpose of allowing the city to release itself from the contract. The city has refused for nearly two years to pay for water and light secured from the company. Judge Lochren holds that the contracts entered into by the company and the city are valid, and directs a decree to be entered adjudging that the Anoka Water Works, Electric Light and Power company recover from the city of Anoka the amounts sued for.

Grand Rapids Officials Held for Trial for Conspiracy to Procure Municipal Contract.

The grand jury at Grand Rapids, Mich., handed down six indictments, June 15, charging conspiracy, on July 26, 1900, to procure a contract for some persons, to furnish the city of Grand Rapids with Lake Michigan water. The persons indicted are Lant K. Salisbury, city attorney; Thos. F. McGarry, Stilson V. McLeod and Gerritt Albers of Grand Rapids; Henry A. Taylor, Jr., of New York City. The sixth indictment was suppressed on the order of the judge until service can be secured.

Thos. F. McGarry and Henry A. Taylor, Jr., eastern capitalists, were arrested June 17 and arraigned in the Superior court, charged with bribery and conspiracy in connection with the attempt to secure a water contract from the city officials by alleged unlawful means. They were released on $5,000 bail each and ordered to appear June 24, when the date of trial will be set.

Patents and Sewage Purification.

To the Editor of Municipal Engineering:

Sir—I note with regret your editorial, "Patents and Sewage Purification," because you decide a case of great importance before it is submitted to the court for adjudication. In justice to the engineering profession and cities and towns who are tempted to use our system without paying attention to our claims for royalty you should give publicity to the following facts:

Amasa S. Glover of Brockton, Mass., discovered septic action and applied it to sewage disposal in 1881. His application for a patent was dated Oct. 15 and the patent was issued May 30, 1882. The patent is numbered 258,744. Mr. F. Herbert Snow, civil engineer of Boston, then of Brockton, made the drawings for the patent to cover septic action. Any city or municipality using septic action during the life of the patent is liable to Mr. Glover's assigns for damages. In 1895 Mr. Glover discovered and patented an improvement on the septic tank by adding filtration to the process. He applied for the patent September 23 and was granted the patent May 5, 1896. The patent is number 559,522. I was employed at the time as consulting engineer to perfect Mr. Glover's discovery and knew just what he claimed. That the system was unknown at the time is shown by the report of the Massachusetts state board of health for 1895, page 53, wherein is condemned the system as applied to Andover. They condemned it because the flow of sewage through the septic tank was continuous. The works designed for Andover have not as yet been improved upon in efficiency and economy. The works were designed under the Glover patents and the patents are explained by the works.

The drawing up of a patent is intrusted to lawyers for brevity and clearness. Messrs. Wright, Brown and Quinby knew just what was intended to be claimed by the patent but were a little mystified as to the process. Line 59, page 1 of the patent, reads: "The primary beds are constructed to arrest the solid matter and permit the escape of the liquid matter wholly through filtering material into the secondary beds, so that the effluent will contain comparatively little offensive matter. The primary beds may be of any suitable construction to accomplish this end. For example:" The words "wholly through filtering material, etc.," referred to an arrangement at the outlet of the bed or tank by which the discharge was drawn, not from the top or bottom of the bed or tank, but midway. The American Sewage Disposal company of Boston, which owns the Glover patent, has expended several thousand dollars in giving publicity to its claim so that municipalities would not ignorantly infringe upon its rights. It is my opinion that the claims of the company are valid and that in good time suits will be brought to establish the validity and scope of the patent. I know that we are the discoverers of septic action, and are entitled to some regard for the real benefit to the public obtained by using the system.

I have given the widest publicity to our claims so that parties will not infringe upon us without warning. Our solicitor, Mr. Edward P. Payson of Boston, undoubt-

edly will inform any engineers as to the validity of our claims.

JOHN N. McCLINTOCK.

Comment upon this letter is made in our Editorial Department under the same title.

Electrolysis of Water Pipes in Dayton, O., Again Serious.

The electrolysis situation in Dayton, O., is said to be serious. Many water pipes have been greatly damaged and the water works and fire departments are greatly handicapped. The water works department has been making repairs for some time where needed. It is stated if electrolysis continues its work very few services in the city will remain unimpaired.

Effect of Tannery Wastes on Sewage Disposal.

From the report of a recent English decision upon the right of manufacturing establishments to discharge their refuse into streams the following extract is made showing that the deleterious effect of the factory discharge must be proved before it can be restrained. It is probable that similar decisions would be rendered in most American courts, although the statutory provisions in all states but one or two are not so clear as those of England:

The real cause of action in this case was founded on sec. 7 of the Rivers Pollution Act, 1876. That section conferred a benefit on persons carrying on trade—namely, a right to drain into the public sewers. It enacted that: 'Every sanitary or other local authority having sewers under their control shall give facilities for enabling manufacturers within their district to carry the liquids proceeding from their factories or manufacturing processes into such sewers.' That was a statutory right given to manufacturers. But it was subject to a limitation. The section proceeded: 'Provided that this section shall not extend to compel any sanitary or other local authority to admit into their sewers any liquid which would prejudicially affect such sewers or the disposal by sale, application to land or otherwise, of the sewage matter conveyed along such sewers.' Here the plaintiffs, who were a local authority, said that the defendants, who carried on the trade of tanners, although they had a prima-facie right to drain the liquids coming from their tannery into the public sewers, yet ought not to be allowed to do so because the liquids were injurious to the application to land of the sewage matter conveyed along the sewers. They said that the effluent from the tannery was such that when it came on to their sewage farm it killed the microbes which otherwise would have got rid of the impurities in the sewage. The whole issue was whether that was true. There was a large body of evidence given at the trial on one side and on the other, and that evidence was very complicated, the expert witnesses who were called not only giving evidence quite inconsistent with one another, but some of them giving evidence in cross-examination which was quite inconsistent with what they said in examination-in-chief. The defendants' point was that the cause of the microbes being killed was not the effluent of their tannery, but the methods which the plaintiffs adopted of managing and working their sewage farm. Mr. Justice Mathew considered that point and thought that it was made out, and he gave judgment for the defendants. There was no ground whatever for interfering with his decision. The Lords Justices delivered judgment to the same effect.

Experiments in Chicago on Garbage Used as Fuel.

Heat produced by the combustion of garbage can be utilized to furnish steam for generating electric power, according to Commissioner of Public Works Blocki of Chicago. Mr. Blocki stated recently that the plant in Sedgwick-st. has been operating several days without the use of coal and has steadily kept up the consumption of twenty tons of garbage a day. Steam pressure of seventy-five pounds has been maintained in addition, and this can be turned to account in furnishing electricity for the city lighting plant.

Powdered Coal for Fuel.

The successful adaptation of powdered coal as fuel for rotary cement kilns suggests its use for other purposes. One prominent cement company has recently installed a plant for burning powdered coal under its boilers which promises to be very successful. One valuable feature is the absence of smoke, the combustion being complete, in this way being an improvement over mechanical strokers and most other smoke consuming devices. The system is probably not economical for small plants, and this gives an added value to large power and heating plants in cities, to generate and distribute power, light and heat among small users.

The Indiana Street Improvement Law.

The important provisions of the new Indiana law providing for the improvement of streets in cities not operating under special charters, were explained at the recent meeting of the Indiana Municipal League by J. T. Merryman, city attorney of Decatur. The following is extracted from his paper:

Section one of this new act authorizes the common council of a city, not operating under a special charter, by a two-thirds vote of all the members to declare by resolution the necessity of a street, alley or sewer improvement. No provision is made in this section, or the whole body of the law, for the filing of any petition; but it is not to be inferred that the initial step cannot be properly taken upon petition. Under this section, such improvement is ordered by the common council by the adoption of a resolution, whereas, under the

former law, it could have been done by ordinance or resolution.

Immediately upon the passage of the resolution, a notice is to be given of the letting of the contract by three weeks' publication. At this initial stage of the proceedings, if two-thirds of the property-owners, who reside upon lots abutting the proposed improvement, and who represent two-thirds of the number of lineal feet of such improvement, remonstrate against the proposed imrpovement, then all further proceedings must be abandoned.

Section 2 makes ample provisions for essential conditions to every contract and bond for municipal improvement, and, if strictly followed, will avoid many questions that might arise between contractors and common councils concerning the conditions thereof.

Under section 3, upon the completion of the work, the city civil engineer reports that fact with the total cost of the improvement to the common council, which, at once, by resolution, refers the matter to the city commissioners and fixes a time and place for them to meet and view the work; and, within fifteen days thereafter, they shall file with the city clerk a report of all the land or lots benefited or damaged with the names of the respective owners.

Upon this report, the common council fix a time and place when and where (that sounds like the "Barrett law") the city commissioners will assess the cost of the improvement upon the property benefited. Two weeks' notice is then given to property-owners, all their names being mentioned in the notice, when said assessment will be made. At such hearing, said commissioners assess the benefits or damages accruing to the property affected, taking in omitted property, upon giving five days' personal notice to the owner if a resident, if a non-resident, ten days' notice by publication, and within thirty days make their final report to the common council. And then under the provisions of section four, after a ten days' notice by publication to all persons interested, the common council takes final action on the report of assessments and may modify or confirm the same. At this time any person interested may present any objections he may have to such assessment; and this final action of the common council constitutes the assessment of benefits and damages, in the amount named, against the respective tracts of real estate and which at once becomes a fixed lien thereon, and, after which time, no suit will lie to enjoin or restrain the collection thereof, and no question can be raised as to the validity of the proceedings except upon appeal as provided in the act.

Section five provides that any person owing any tract of land assessed for benefits or damages on account of the improvement may appeal to the circuit court within twenty days from the final action of the common council upon executing a proper undertaking, to be approved by the city clerk, conditioned that he will duly prosecute the appeal and pay costs if adjudged against him, and file therewith a statement of his grievances. According to this section, such grievances can only be:

1. The invalidity of the proceedings.
2. That the benefits assessed are too high or the damages allowed him are too low.
3. That the benefits assessed against him are too high in proportion to benefits assessed against other property similarly situated.

Some English Figures on Durability and Cost of Wooden Pavements.

Figures showing the relative cost of different systems of street paving have been submitted in connection with the proposal of the Otley District Council to introduce wood paving. It is pointed out that hard Australian wood, suitable for heavy traffic, can be laid down for 18s per yard. In Edinburgh the cost per yard for hard wood has been 17s; in Bradford it was 17s 6d. Usually, however, the cost is a trifle more at the outset, and, therefore, 18s per yard for 1,000 yards is a reasonable estimate. This figure, however, includes the concrete foundation, which adds a good deal to the initial cost, and which is not required a second time, as when the setts become worn they may be taken up, trimmed and relaid, or new ones put down on the same foundation.

As to the "life" of the wood setts, the following are a few figures regarding the softer class of setts—Bury and Manchester, 15 years; Hanley, 12 years; Birmingham, 10 years; and the Strand give an estimate of from 8 to 10 years. So far as regards the hard woods, a severe test has been made by the authorities at St. Pancras, where it is computed that the vehicular traffic passing over a certain portion of their road amounts to 575,000 tons per yard in width of road per annum, and the wear of the setts during a year was only an eighth of an inch. In a street near the Town Hall in Sheffield, where soft wood was used, three-eighths of an inch were worn in thirty months. Hard wood, in the same length of time, lost three-sixteenths of an inch in the same street. The cost of the up-keep of these roads varies considerably. In Birmingham it is as high as 7d to 9d p. ·ard for repairs and 4d for cleaning, whereas in Bolton the whole is done for 6d per yard per year, and in Manchester for 4d. These figures apply to both classes of wocd.

It is also pointed out that the Local Government Board will not grant loans on soft wood for more than five years, whereas for hard wood they will extend the period of repayment for ten years.

An Opinion on Asphalt Blocks for Pavements.

B. T. Fendall, chief engineer of the department of public improvements, Baltimore, Md., says that asphalt blocks are the very best material for paving small cities. Mr. Fendall and Professor Johnson of Johns Hopkins university have elaborated a system of tests for different materials used for street paving. In speaking of relative values of asphalt block and brick, Mr. Fendall says: "The perfect pavement, like the perfect man, has not yet arrived, but you can say for me that

an asphalt block made with trap rock is the best all round material yet produced." He states that asphalt block laid in Baltimore eighteen years ago is as good as the day it was laid, and has cost the city virtually nothing for repairs.

City Not Considered an Abutting Property-Owner at Street Intersection.

The Iowa supreme court rendered a decision recently affirming the judgment of the superior court in the case of the city of Omaha and Council Bluffs Street Railway and Bridge company. The city asked judgment against the defendants on three counts, one of which was for paving between the tracks and one foot outside thereof at intersections where the street had been paved by the city previous to the time the defendants laid their second track thereon. The counsel for the city concluded that the city, having title to the streets, was an abutting property-owner whenever a street intersected that upon which the defendants' track was laid. It was urged that the ordinance stood as a contract between the parties and that it was understood and intended the defendants should pay for paving at intersections.

The supreme court says: "To say that the words 'property-owners abutting' (as found in the ordinance) were intended to apply to the city as owner of its streets, is at variance with what is commonly understood, and foreign to what was intended." It holds that, while the city holds title to its streets within its limits, it does not do so as owner but for the public, for the uses and purposes authorized by law. Judgment on this count was against plaintiff in the lower court and it is affirmed.

Bituminous Pavement Specification.

From the specifications forming part of the letters patent issued June 4 to Frederick J. Warren, the following description of the method of mixing and laying the pavement is taken:

The foundation layer of stone may be of the macadam order or the Telford arrangement or a combination of the two, and it is laid in any usual way. Upon it is arranged the layer of smaller stone, which preferably are coated or partly coated with coal tar, coal tar pitch, asphalt, or a mixture of them or other equivalent bituminous material. The stones composing this layer will vary in size from two inches in diameter, and the layer is thoroughly rolled into the foundation layer and will when completed furnish a surface which is coarse and a constituency which is more or less cellular in character. Upon and into this prepared surface is then thoroughly rolled a heavy layer of specially-prepared ingredients which have reference to their packing and binding character with regard to each other and also with respect to the character of the surface which is to receive it and of the voids, cells or spaces in it. This layer is a binding or surfacing layer, and it is constituted to unite with the rough surface of its supporting-layer by entering the spaces, channels and voids between the stones thereof to a very considerable extent and so as to fill them. It is further constituted to make a continuous, homogeneous, solid layer of its own composition above the line of union with the layer below and to provide a hard, firm, solid, waterproof, tenacious, non-friable covering for the foundation, and the surface of which may serve as the finished surface of the pavement or may act to receive a finishing surface of a somewhat different character. It is obvious from what I have said that this layer must be very carefully prepared, as upon it hinges the effectiveness of the invention. It is composed of a mixture of relatively coarse particles one-half inch to three inches in diameter, intermediate particles one-tenth inch to one-half inch in diameter, and fine particles (an impalpable powder) to one-tenth inch in diameter, suitably proportioned, graded, and thoroughly mixed, either hot or cold, with an incorporated composition of coal tar, coal tar pitch, asphalt, or other equivalent bituminous material or a combination of them. The ingredients are such as will pass through screens having a three-inch mesh, a half inch mesh, one-tenth of an inch mesh, one-fortieth of an inch mesh, one-eightieth of an inch mesh, and one two-hundredth of an inch mesh. Of the ingredients passing through a screen of three-inch mesh and remaining upon a screen of one-half-inch mesh I take about seventy parts. Of the ingredients passing through a screen of a one-half-inch mesh and remaining upon a screen of one-tenth-inch mesh I take twenty parts and the same as to screens of one-tenth-inch mesh and one-fortieth-inch mesh. I take four parts of screens of one-fortieth-inch mesh and one-eightieth-inch mesh, three parts of screens of one-eightieth-inch mesh and one two-hundredth-inch mesh, and of material passing through a screen of one-two-hundredth-inch mesh one part. To one hundred parts, by weight, of these ingredients, in the proportions above stated, there are added about six parts of the coal tar, coal tar pitch, asphalt, or a mixture of them or other equivalent bituminous material, which, preferably, has been heated in a separate vessel, and the ingredients and the bituminous material are intimately intermingled. The percentage of the bituminous material to the aggregate of ingredients may be varied and to obtain the best results must be varied as the shape and size of the larger particles in the aggregate vary and also with the degree of purity of the bituminous material used.

The surface of the roadway may or may not be covered with a thin coating of bituminous mixture of sand, gravel, screenings, or gravel mixed with coal tar or other equivalent material.

I am aware that tarred macadam pavements or roadways have been used in which the several courses of stone are coated with tar in an effort to hold the top course of tarred stone about two inches in size in position by spreading over and roll-

ing into the surface a fine mixture of sand and tar, but this only partially fills the voids in the top course of stone, leaving voids in the lower portion of this course of stone, so that under traffic the stones become displaced and lose the essential solidity desired. I am also aware that asphalt pavement mixtures have been made with particles of sand and pulverized stone carefully graded in size from about one-tenth of an inch in diameter down to an impalpable powder, so as to secure the least possible voids and greatest possible density within those limits.

By my improvement I obviate the difficulty of lack of solidity of the top course of the tarred macadam pavements as now laid by thoroughly mixing and incorporating with the larger particles of the aggregate finer particles of crushed stone or sand or other equivalent, so graded as to give a minimum of voids, which are then filled with coal tar, coal tar pitch, asphalt or other equivalent bituminous material, forming a solid bituminous, concrete wearing surface and which I prefer to lay from one to three inches or more in thickness. By using in the concrete coarse particles of stone or gravel from about one-half inch to about three inches in diameter my invention provides a composition having fewer voids, and therefore requiring less of the bituminous material to make a solid concrete than is now used in surface mixture for asphalt or other bituminous pavements.

The concrete mixture which I have described may also be used as an intermediate or binder course between hydraulic cement, concrete, bituminous concrete, or broken stone foundation and the wearing surface of an ordinary asphalt pavement and is an improvement on binder courses previously used, for the reason that it forms a more solid and impervious binder course.

Determination of Free Lime and Gypsum in Cement.

New methods of determining approximately and quickly the amounts of free lime and of gypsum in cement are given in a recent number of the English "Surveyor and Municipal and County Engineer" as follows:

Use 10 grammes of the cement in question, and empty into 400 cubic centimeters of water in an ordinary 500 cubic centimeter tubular measure, with 100 markings and about 10 in. between zero and containing mark.

Cork or place the palm of the hand over the mouth of the tube, and shake up for a couple of minutes, so as to well mix. Twist in fingers to get equal settlement of the cement, and stand by for an hour so as to clarify.

Then, from a saturated solution of ammonium oxalate, pour in up to the 500 cubic centimeter mark. At once a white cloud of lime oxalate will form, which allow to settle for a couple of hours and note hight above the cement.

The space of ½ a mark will equal ⅛ per cent. free lime in the cement.

The space of 1 mark will equal 1 per cent. free lime in the cement.

These percentages are approximate only, and purposely given slightly in favor of the contractor.

To cleanse the tube after use, gently disturb the cement with a piece of twisted wire, shake up and throw away. Pour in a little hydrochloric acid to free any adhering substance, after which on rinsing with water the tube is again ready for use.

A saturated solution of barium chloride will reveal the presence of gypsum in the same way, but in this case ½ a mark will indicate 1 per cent., while 1 mark will indicate 2 per cent., etc.

Cement Grain Storage Tanks in Indianapolis.

The Hoosier State flour mills at Indianapolis, Ind., has just completed four circular cement tanks for the storage of grain. The tanks are 60 feet high, 26 feet in diameter, and have a combined capacity of 82,000 bushels. Imbedded in the cement walls, which are 8 inches thick, are iron bands 1½ inches wide, and 8 inches apart. The bands are really one band running round and round in spiral form from bottom to top. The walls are built two and three feet at a time, then allowed to harden before proceeding higher, which gives a layer appearance to the outside of the walls. A little house on top contains a common rubber belt, about 16 inches wide, on which wheat from the cars is carried into the tanks. There is a similar belt in a tunnel on the ground between the tanks in which the wheat falls from the tanks when wanted, and is carried to the mills to be ground or rolled. Indianapolis is the second city in which cement tanks have been adopted, Duluth, Minn., being the first.

Comparative Cost of Street Sweeping by Various Machines and by Hand.

The board of street commissioners of Hartford, Conn., which has been investigating street sweeping for some time, makes the following statement: "A steam sweeper, which sweeps and takes up the dirt by suction, has been used for two seasons with good results in dry weather. The machine was quite crude and needed constant repairs, but has swept pavements satisfactorily and without annoyance to people by dust at the rate of 23.2 cents per 1,000 square yards. A rotary sweeper, which can only be used in connection with a water sprinkler, has done good work at a cost of 30.4 cents per 1,000 square yards. Hand sweeping has been found to give good results, but cost 50.3 cents."

Cement for South Africa.

Consul-General Guenther writes from Frankfort, April 15, 1901: "According to official reports, South Africa is a good market for cement. All public buildings, stores, and dwellings are coated with cement. There are few wooden buildings erected.

The masons in South Africa are mostly Malays. They are skilled in their trade and do the work very neatly. Cement is also used in the construction of aqueducts, wharves, chimneys, walls, etc. While the principal import of cement is from Great Britain, considerable quantities are also imported from Belgium and Germany, the latter, on account of its cheapness, increasing. Belgian cement is of good quality and as cheap as the English article. The reports state that American cement could compete well, as transportation from our country is not higher than from Europe. Cement cannot be made in South Africa for lack of raw material."

Another Decision on the Prevailing Rate of Wages in New York Labor Law.

The appellate division of the New York supreme court has handed down a decision declaring that New York City has the right to make any terms it chooses with contractors, and that where the contract states that the "prevailing rate of wages" shall be paid, the contractor has no right to pay less and plead the unconstitutionality of the prevailing rate of wages law. The decision was rendered in the case of Eugene Lentilhon against Bird S. Coler, city comptroller, who held up payment for work performed under a contract for the removal of the Forty-second-st reservoir. Comptroller Coler held up the payment on the grounds that the contractor had compelled his men to work more than eight hours a day, and that he had not paid the "prevailing rate of wages" as required by the labor law.

Technical Meetings.

The annual meeting of the American Institute of Electrical Engineers was held in New York City May 21. Dr. Schuyler S. Wheeler presented the institute the valuable library of Latimer Clark, one of the foremost electrical engineers. Dr. Wheeler secured by purchase the rights belonging to Mr. Clark's estate in the library itself, and also in all the collections of photographs, autographs, manuscripts, etc. in connection with it.

The twenty-fourth convention of the National Electric Light association was held at Niagara Falls May 21, 22 and 23. The papers presented were the following: "The Foresee (4-C) System of Charging," by L. R. Wallis; "The Practical Side of the Incandescent Lamp," by Francis W. Willcox; "Arc Lighting at the Beginning of the Twentieth Century," H. W. Hillman; "A Station Load Diagram," C. R. Van Trump, Wilmington, Del.; "Storage Batteries in Central Station Work," Augustus Tredwell, jr. Reports were submitted by the committee on incandescent lamps, committee on amendments to freight classification of electrical apparatus, committee for investigating the photometric values of arc lamps. Officers were elected as folows: President, Henry W. Doherty, Denver, Col.; first vice-president, Louis A. Ferguson, Chicago, Ill.; second vice-president, Charles B. Hunt, London, Ont.

At a meeting of the Western Society of Engineers, Chicago, Ill., June 5, City Engineer Ericson read a paper in which he stated that 76 per cent. of Chicago's water supply is wasted. He said that the cost of the fuel used in operating the pumping station amounted to $350,000 annually, so that the comparative expense of pumping water that went to waste was evidently considerable. He believes that most of the loss or waste of water in Chicago is due to defective plumbing and to mains improperly connected or too old to give best service. It was voted not to hold meetings during July and August unless there was a special call.

The second meeting of the Roentgen Society of the United States will be held at Buffalo, N. Y., Sept. 10 and 11. The program will be mailed about the middle of August. Dr. J. Rudis-Jicinsky, Grand Rapids, Mich.

The National League of Improvement associations will hold its annual convention Aug. 12, 13, 14 and 15. The sessions of the first three days will be held in Buffalo, N. Y., and the last day at Chautauqua. The league invites co-operation of civic clubs, horticultural and floral unions, commercial bodies, religious societies, municipal art associations, good roads leagues, literary socities, etc.

The ninth annual meeting of the Society for the Promotion of Engineering Education is held at Buffalo, N. Y., June 29 to July 2.

The sixth annual convention of the International Association of Municipal Electricians will be held at Niagara Falls, N. Y., Sept. 2, 3 and 4.

At the annual meeting of the New York Electrical Society, held June 6, officers were elected as follows: President, Arthur Williams; vice-presidents, C. E. Knox, C. O. Baker, Jr., S. L. Nicholson, H. A. Lardner, George Herbert Condict, H. V. Parsell; secretary George H. Guy; treasurer, Henry A. Sinclair.

The twentieth annual meeting of the American Street Railway Association will be held in New York City, Oct. 9, 10 and 11.

A good roads convention will be held in Evansville, Ind., July 20 and 21. Governor Durbin has been asked to issue a call making it a state convention. The meeting will be presided over by the Hon. W. H. Moore of Chicago, president of the National Good Roads Association. A state organization will be formed, with officers in every county in the state.

The American Society of Municipal Improvements meets at Niagara Falls, Oct. 1-4.

Indianapolis Electric Light Specifications.

As will be seen from our proposal columns the city of Indianapolis will receive bids on July 15 for furnishing public, private and commercial lighting by electricity to the city and its inhabitants and letting, if necessary, a franchise for the use of the streets. For the purpose of giving full information the Board of Public Works has printed a pamphlet of 36 pages, giving the specifications under which the contract is to be let, the general electric lighting ordinance of 1888, the contract with the Indianapolis Light & Power company for public lighting, which expires July 7, 1903, and the contract with the Home Heating and Lighting company for furnishing and distributing heat, light and power by hot water, steam or electricity to inhabitants of the city.

The term of the new contract is to be ten years from July 7, 1903, unless it is decided to make it for a longer period. Fifteen hundred arc lights of normal 2,000 candlepower and additions from time to time are to be furnished the city at prices bid, most of them at locations now occupied by lights. Underground conduits are provided for according to existing ordinances. A percentage of gross receipts from public lighting and from private lighting is to be bid for the privilege of the franchise. Terms for purchase by the city are provided for.

Personal Notes.

H. Y. Scovill has been elected city clerk at Rockford, Ill.

William Mathew has been appointed engineer at Douglas, Wyo.

Joseph A. Latham has been elected engineer at Cranston, R. I.

J. R. Roy, C. E., has been appointed superintendent of public works at Ottawa, Canada.

John F. Butler has been appointed assistant superintendent of streets at Hartford, Conn.

Leslie M. Long has been appointed chief engineer of the board of public improvements at Denver, Colo.

Douglas T. Corning has been appointed assistant engineer in the water works department, at Troy, N. Y.

S. A. Ferguson has been appointed city engineer at Detroit, Mich., to succeed Robert H. McCormick, resigned.

Chester A. Boyce has been appointed water commissioner at Canandaigua, N. Y., to succeed W. H. Tuttle, resigned.

C. W. Dill has been appointed engineer of the roadway department at Toronto, Ont., to succeed Cecil B. Smith, resigned.

Irvin Butterworth, Columbus, O., has been appointed general manager of the Denver Gas and Electric company, Denver, Col.

W. T. McCormick, superintendent of water works at Tuscaloosa, Ala., has been appointed engineer for paving work in that city.

Louis C. Kelsey has been appointed city engineer at Salt Lake City, Utah, to succeed his brother, F. C. Kelsey, who resigned.

B. W. Cassell has been elected superintendent and S. D. Richardson engineer of the water and light plant of West Plains, Mo.

Theodore Miller has been appointed chief engineer of the Kenosha Water Works, at Kenosha, Wis., to succeed Henry R. Cumisky, resigned.

Kingsley L. Martin, Assoc. Am. Soc. C. E., has been appointed resident engineer to the New East River bridge commissioners, New York City.

Prof. Olin H. Landreth of Union College, Schenectady, N. Y., has been reappointed consulting engineer to the New York State board of health.

Charles W. Leavitt, Jr., Assoc. M. Am. Soc. C. E. has been retained as landscape gardener by the New York Central & Hudson River Railway company.

Prof. C. A. Adams, Jr., has been reappointed assistant professor of electric engineering and Prof. L. J. Johnson assistant professor of civil engineering of Harvard university.

E. M. Bigelow, M. Am. Soc. C. E. has again been appointed director of the department of public works, at Pittsburg, Pa., succeeding George W. Wilson. Mr. Bigelow held this position for many years.

Mr. Thomas Curtis Clarke, past president of the American Society of Civil Engineers died on June 15. He was one of the most noted bridge engineers of the world, and was one of the first to use concrete largely in foundations and piers.

Julian Kendrick, city engineer of Birmingham, Ala., has been appointed chief engineer of the Jefferson county sanitary commission, which has charge of the sewerage and sewerage disposal works of Birmingham and ten or twelve adjoining towns.

Lucian E. N. Thompson has resigned his position as superintendent of water works at Dunkirk, N. Y., which position he has held for a number of years, to accept a position with Hingston & Woods of Buffalo, contractors for dredging and public work.

Henry B. Rust, Assoc. M. Am. Soc. C. E., has resigned his position as assistant engineer of bureau of engineering and construction, department of public works, at Pittsburg, and accepted one as assistant engineer for the Colorado Fuel and Iron company, Pueblo, Col.

Edward W. Cummings, formerly assistant supervising engineer on the Cedar River Water supply system at Seattle, Wash., has been appointed chief engineer of the proposed new water system at Port Townsend, Wash. Mr. Cummings's headquarters will be in Seattle.

R. P. Garrett has been appointed civil engineer to the president of the board of public improvements at St. Louis, Mo. Hiram Phillips is president of the board and Mr. Garrett was principal assistant

engineer to him for several years while he practiced civil engineering.

Cecil B. Smith, Mem. Am. Soc. C. E., assistant engineer in city engineers department, Toronto, Canada, and formerly assistant professor of civil engineering in McGill university, and William B. Aldrich Mem. Am. Inst. C. E., Mem. Am. Soc. C. E. professor of electrical engineering at university of Illinois, have opened an office as consulting engineers, at 101-103 Mail and Empire Bldg., Toronto.

Mayors have been elected as follows: Robert Rohl, Centralia, Ill.; Sawyer, Monmouth, Ill.; Henry Brickman, Kankakee, Ill.; Charles F. Shilling, Decatur, Ill.; Dr. Lyle, Virginia, Ill.; G. A. Huenkemier, Freeport, Ill.; A. W. Young, re-elected, Alton, Ill.; A. F. Weiss, Carlinsville, Ill.; Amasa Hutchins, Rockford, Ill.; Jed Miller, Lincoln, Ill.; Lewis B. Thomas, Bloomington, Ill.; P. J. Martin, Waterloo, Ia.

MACHINERY AND TRADE.

A Popular Trench Pump.

A pump which will handle rapidly water containing sand, gravel or sewage without choking, and will require but little power is found in that manufactured by the Edson Manufacturing company, 132 Commercial-st., Boston, Mass. A single man can operate a pump outfit with a capacity up to 6,000 gallons an hour. It is said that 90 per cent of the New England contractors know and use these pumps and that over 30 per cent. of the water works in the United States are supplied with them. The company makes pole and pile sinking outfits of various capacities which are very successful and several other special sets of apparatus for contractors.

Trade Publications.

The Acme Road Machinery company of Frankfort, N. Y., issue a handsome 84-page illustrated catalogue of their rock crushers and elevators, screens, road grading machines, dumping and garbage wagons, contractors' dumping carts and cars, barrows, plows, scrapers, road rollers, engines, sprinkling carts, street sweepers and sweeping apparatus, water tanks, pumps, rock drills, jacks, winches, scales, etc.

The William G. Hartranft Cement company, Philadelphia, have recently issued a pamphlet on the "Old Dominion" brand of Portland cement, of which they are the sales agents, which they will send to any address on application.

The Jeffrey Mfg. company of Columbus, O., is sowing broadcast its circular, No. 61, on Elevating and Conveying Machinery, which is devoted exclusively to photographs of installations of their machinery and drawings of details. Some space is devoted also to crushers, screens and other specialties of their manufacture.

Trade Notes.

ASPHALT.

The asphalt mine located at Burnet, Tex., has been leased by a Dallas company, according to press reports.

The Continental Asphalt Paving company of New York City was incorporated May 29, with a capital stock of $100,000, to construct asphalt work of various kinds. The incorporators are Maurice Featherson of New York City and Charles M. Warner and Patrick Quinlan of Syracuse. A general office has been established at 32 Broadway, New York City. An asphalt plant is under course of construction at Long Island City. If successful in its fight for possession of the asphalt lake, La Felicidad, in Venezuela, the company will use that product only.

The asphalt mines of the Carpinteria valley, California, are to be reopened soon, according to press reports from Santa Barbara. The mines have been closed for a number of months. They are owned by the Alcatraz Asphalt company.

Deposits of asphalt have been discovered in Washington county, Alabama, about sixteen miles from St. Stephens, according to press reports.

Asphalt has been discovered in large quantities within three miles of Texarkana, Ark., according to press reports, which also state that a company has been organized and a charter secured to prospect for oils, minerals, etc.

The Western Paving and Supply company, Indianapolis, Ind., formerly the Watson & Perkins company of Chicago, complied with the foreign corporation law June 15 by filing articles stating that $90,000 of its $100,000 capital is represented in this state, and designating as its resident agent John D. Thomson.

The Vulcanite Paving company, New York City, has been incorporated by A. W. Sewall, A. L. Robertson and Clyde Brown of New York City.

BRICK.

The Boone Brick Tile and Paving company, Boone, Ia., has been incorporated by O. W. Nystrand, J. T. Yegge, f. Bowman, F. Hollenbeck and E. A. Kellogg.

George Laut, Sr., Evansville, Ind., was adjudicated a bankrupt, June 20, and a meeting of his creditors will be held July 2, at which time said creditors may attend, prove their claims, appoint a trustee, etc. Orville W. McGinnis, referee in bankruptcy.

CEMENT.

The Farwell Portland Cement company, Farwell, Mich., has been organized with the following officers: President, J. L. Littlefield; vice-president, Geo. W. Graham; secretary, W. C. Fuller; treasurer, T. F. Bingham.

The Mankato Cement Works, at Mankato, Minn., has been leased by P. H. Carney for three years with the privilege of purchase during the term of the lease.

The Garrison Coal, Lime and Cement company has just been incorporated for manufacturing purposes with principal office at 122 California-ave., North Atlantic City, N. J.

The Texas Portland Cement and Lime company of Galveston, Tex., has been incorporated by Joseph Levy, R. Waverly Smith, Joseph Nussbaum, M. Moore, Jas. I. Taylor and J. Clark.

An American syndicate, composed largely of owners of cement works in Chicago and New York, last year bought land in the vicinity of Sidney on Vancouver Island, for the purpose of operating a large Portland cement factory there. It is said that an abundance of good cement clay has been discovered around Sidney. During the present year the works are expected to be in operation, with an output of 300 barrels daily, which will be gradually increased to 2,000 barrels.

The Atlas Cement company of New York will establish a cement plant about two miles southwest of Hannibal, Mo., at a cost of $650,000.

The Marksboro Portland Cement company, Marksboro, N. J., has been organized, with a capital of $400,000. The present plans call for the erection of ten buildings.

The Clare Portland Cement company, Clare, Mich., with headquarters at Saginaw, has been formed to develop deposits in the neighborhood of Five Lakes, near Clare. The officers of the company are: President, Henry Robinson, Akron, O.; secretary, C. W. Perry, Clare, Mich.; treasurer, F. G. Benham, Saginaw.

The Hecla Cement and Coal Mining company, recently organized, has purchased 135 acres of land just outside of West Bay City, Mich., and will erect a plant there soon.

LIGHT, HEAT AND POWER.

The properties of Kerlin Bros. and the Tiffin Electric Light company, Tiffin, O., will be merged into the Consolidated Gas and Light company. The incorporators of the new company are M. B. Daly, R. W. Kirely and C. F. M. Niles of Toledo, J. M. Barr of Findlay, William H. Dore of Tiffin.

The interests of the Birmingham Railway, Light and Power company and the Birmingham Gas company, Birmingham, Ala., will be consolidated.

The Forester Electric Light company, Chicago, Ill., has been incorporated to deal in electric machinery and appliances. The incorporators are A. A. Rolf, Jacob E. Takkeir and Peter J. Karstens.

The United States Electrical Manufacturing company has been organized at Butler, Pa., and will erect a plant for the manufacture of electrical supplies and engage in building telephone systems. The officers are: President, John W. Brown; vice-president, M. A. Berkimer; secretary, W. H. Miller; treasurer, C. A. Bailey.

Homer T. Yaryan of Toledo, O., has been granted a franchise for a hot water plant at Richmond, Ind.

Newly incorporated lighting companies: Suburban Electric Light company, Oakland, Cal.; Tipton Electric Light company, Tipton, Ind.; Excelsior Lighting company, Marshalltown, Ia.; Corning Gas and Electric company, Corning, N. Y.; Syracuse Lighting company, Syracuse, N. Y.; Enterprise Heat, Light and Power company, LaSalle, Ill.; Clarendon Electric Light and Power company, Clarendon, Tex.

The Northern Electrical Manufacturing company of Madison, Wis., through its Chicago office, secured the contract for the entire equipment of the new Central Station being built by the Citizens' Electric Light company of Battle Creek, Mich. The installation will consist of one 275 and one 135 K. W.,two-phase, Stanley Inductor Alternator, together with station and sub-station switchboards, step-up transformers, etc. This company was awarded the contract by the L. Wolff Mfg. Co., manufacturers of plumbers' supplies, for a complete equipment of generators and motors to be established at their works at Carroll-ave. and Roby-st., Chicago.

SEWER PIPE.

J. N. Neal has leased fifty acres of land at Macon, Ga., and will build at once a large plant for the manufacture of brick, tile and sewer pipe.

The Arizona Clay Manufacturing company has been organized at Benson, Ariz., to manufacture common and pressed brick, drain and sewer pipe, etc. The officers of the company are: President, J. M. Castaneda, Benson; vice-president, R. P. Brown of Bisbee; secretary and treasurer, J. T. Hord, Bisbee; general manager, J. W. Wallace, Bisbee.

WATER.

Newly incorporated water companies: Holt's Heights Water company, Honey Grove, Tex.; Tell City Water and Light company, Tell City, Ind.; Rock River Water company, Prophetstown, Ill.; Vallecitus Water company, San Francisco, Cal.; Grand Rapids Water Supply company, Dover, Del.; New Egypt Water company, New Egypt, N. J.; Marion City Water company, Marion, O.; Abbotsford Water, Light and Power company, Milwaukee, Wis.; Seaside Water company, Los Angeles, Cal.; Neptunus Water company, Cape May C. H., N. J.

MISCELLANEOUS.

The Mexican Central railroad has contracted for a large steel frame pier to rest upon galvanized steel cylinders 72 inches in diameter, made of ⅝-inch plates. Owing to the great bulk of the cylinders William B. Scaife & Sons, Pittsburg, Pa., were obliged to erect an addition to their large galvanizing plant, especially adapted for this purpose.

The common council of Little Falls, N. Y., has awarded a contract to the United States Voting Machine company for five voting machines.

The O. S. Kelly company of Springfield, O., has been awarded a contract for a 37,000-lb. road roller at Ishpeming, Mich.

The Harrow Spring company, Kalamazoo, Mich., nave contracted with William B. Scaife & Sons, Pittsburg, Pa., for a number of steel frame structures. The main building will be 290 feet long by 90 feet wide by 32½ feet high.

The Lithoid Manufacturing company has purchased a site at Clementon, N. J., and will erect a plant for the manufacture of paving blocks.

William B. Scaife & Sons, Pittsburg, Pa., have received a contract for the design and construction of the buildings for the new plant of the MacPherson Switch and Frog company at Niagara Falls, N. Y. Steel frame construction will be used throughout.

The Jefferson Stone and Macadam company of Kentland, Ind., has been incorporated to mine and quarry stone, manufacture building and paving stone and lime, and furnish motive power.

The American Street Railway and Improvement company, Fuller's bldg., Springfield, Mass., are closing some good orders with several cities and towns on their paving blocks and other materials.

The Concrete-Steel Engineering company, consulting engineers, Park Row Bldg., New York, has been formed by the uniting of Edwin Thacher, consulting engineer, and The Melan Arch Construction company, Wm. Muesser, engineer.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Kansas City, Mo.—The use of Kansas City cement in park work is proposed.

Syracuse, N. Y.—The council rescinded, June 10, all ordinances recently adopted approving paving specifications as prepared by the city engineer. The aldermen, it is claimed, did not discover when they approved the ordinances a pasted slip admitting California asphalt to competition.

St. Louis, Mo.—The street and water departments are investigating the condition of Washington-ave., between Theresa and Grand-aves. The block, which is paved with asphalt, has for several weeks been covered with moisture, which has rendered sprinkling unnecessary, and water has spouted up through cracks in the street. Street Commissioner Varrelmann believes that water pipes under the street have burst.

St. Paul, Minn.—City Engineer Claussen believes that compliance with the paving resolution will increase the cost of paving in this city without any material benefit, and in resolutions sent to the board of public works he ignored the resolution, believing that such requirements would drive brick and sandstone from the field. The new resolution applies to all kinds of paving. It requires a ten-year guarantee, a surety bond for the full amount of the contract and 15 per cent. retained money, on which 4 per cent. interest is to be paid to the city. At present no guarantee or retained money is required for brick and sandstone, and Mr. Claussen is willing to concede a ten-year guarantee and a 35 per cent. surety bond. The asphalt specifications provide for a ten-year guarantee, a 25 per cent. surety bond and 15 per cent. retained money on which 3 per cent. interest is paid.

CONTEMPLATED WORK.

Sioux Falls, S. D.—Asphalt paving is proposed for Duluth-ave.

Burlington, Ia.—New bids will be asked for paving Washington and Front-sts.

Houghton, Mich.—Bids will be asked at once for macadamizing Shelden-st.

Middleport, N. Y.—The village trustees have voted to pave State-st. immediately.

Stillwater, Minn.—The question of paving the downtown streets is being considered.

Aberdeen, S. D.—The council has ordered cement walks constructed on Main-st.

Aurora, Ill.—A petition is being circulated for paving Main-st. with brick.

North Manchester, Ind.—The question of paving Main-st. is being agitated.

Redlands, Cal.—This city proposes to issued $5,000 for paving additional streets.

Atlantic City, N. J.—Vitrified brick and macadam paving is contemplated for Atlantic-ave.

Burlington, Vt.—The issue of $30,000 bonds for permanent road construction is proposed.

Arcola, Ill.—The question of building new sidewalks is being considered. Mayor Monahan.

Adrian, Mich.—The question of issuing $45,000 bonds for paving purposes will be voted on.

Willimantic, Conn.—A petition has been submitted to the selectment for a macadam road.

Benton Harbor, Mich.—(Special.)—Brick paving on concrete or sand foundation is contemplated.

Charleston, Ill.—Ordinances have been adopted for building concrete sidewalks on a number of streets.

Cincinnati, O.—Estimates have been approved for asphalt paving on portions of several streets.

Delaware, Pa.—An ordinance has been passed to pave Twenty-fourth-st., from Edgmont-ave. to Crozer-st.

Jackson, Mich.—The property-owners on Liberty-st. want a cement walk built. Mayor Palmer.

Champaign, Ill.—Petitions are being asked for paving Mathews and Springfield-aves.

Raleigh, N. C.—The question of issuing $100,000 improvement bonds will be voted on July 8.

Philadelphia, Pa.—An ordinance was passed June 13 ordering several streets paved.

West Superior, Wis.—The repaving of Tower-ave., from Third to Twenty-sixth-st., is contemplated.

Elgin, Ill.—A petition for asphalt paving in Spring-st. is being circulated by George Chisholm.

Jackson, Mich.—The property-owners in Liberty-st. have petitioned for a cement sidewalk. Mayor Palmer.

Louisville, Ky.—An ordinance was adopted, June 11, providing for the reconstruction of Broadway from First to Campbell with asphalt.

Norwalk, O.—A petition for a crosswalk at the intersection of Washington and Pleasant-sts. has been granted.

St. Joseph, Mich.—The city council has decided to pave seven streets, five of which will be brick.

Galion, O.—(Special.)—J. O. Ross, cy. clk., says that brick paving on concrete base is contemplated.

Pittsburg, Kas.—About 12,000 sq. yds. of brick paving is proposed. C. G. Waite, cy. engr.

Decatur, Ind.—The question of macadamizing three roads in Jefferson township was favorably voted on June 15.

San Francisco, Cal.—Contracts for about $75,000 of street paving will be let in July, according to prass reports.

Conneaut, O.—Resolutions are pending for paving Broad, Buffalo and Sandusky-sts. Mayor Stanley.

Freeport, Ill.—A resolution was adopted June 18 for paving along the Stephenson-st. side of the court house.

Sedalia, Mo.—A resolution to pave Third-st., between Ohio and Lamire-sts., with vitrified brick, has been adopted.

Watertown, S. D.—Petitions are being considered for cement walks on Indiana-ave. and Walnut-st. Mayor Thomas.

Aurora, Ill.—Some of the residents of Main-st are circulating a petition for for brick paving on Main-st., instead of asphalt.

Freeport, Ill.—Petitions will be presented to council asking that West and Foley-sts. and Douglas-ave. be macadamized.

Bay City, Mich.—The specifications for asphalt paving on Fourth-ave. call for a 10-yr. guarantee. Cy. Engr. Turner.

Wabash, Ind.—The city council unanimously decided June 5, to pave Wabash-st. from Hill to Noble, with asphalt this season.

Lawrence, Kas.—An ordinance has been adopted to curb Indiana-st., from Winthrop to Warren-sts. Mayor Selig.

Palestine, Tex.—The question of issuing $40,000 bonds to pave the business streets will be voted on in July.

New Orleans, La.—The question of paving Jefferson-st., from Charles to Decatur with asphalt is being revived.

Sioux Falls, S. D.—The construction of cement walks in a number of streets is contemplated. Mayor Burnside.

Youngstown, O.—Ordinances have been passed for paving Champion, Walnut, W. Federal, Basin and Boardman-sts.

Sewickley, Pa.—An ordinance has been passed for 2,500 ft. of vitrified brick paving. R. I. Webber, boro. engr.

Des Moines, Ia.—Plans have been prepared for paving Eighth-st., from Forest to Franklin, with asphalt.

New Orleans, La.—The second drainage district of St. Bernard Parish has voted $10,000 for road improvements.

Goshen, Ind.—The construction of a cement walk on Puri-st., from Eighth to Tenth-st., has been authorized. Mayor Deahl.

Hammond, Ind.—The property owners on Clinton-st. have petitioned for brick paving, and on W. Gostlin-st. for macadam paving.

Savanna, Ill.—Ordinances have been passed for about 4½ mis. of cement walks. W. H. Griffith, mayor. W. E. Cottral, cy. clk.

West Hammond, Ind.—A petition is being considered for paving Russell-st., from Oakley-ave. to State Line.

Atlantic City, N. J.—The Pennsylvania Railroad company will probably macadamize Atlantic-ave. this summer or fall.

Sterling, Ill.—(Special.)—M. E. Wilger, cy. clk., says that about twenty-six blocks of macadam and stone paving is contemplated this year.

Ensley, Ala.—Vitrified brick paving with granite curbing is contemplated for Avenue E, from Center to Twenty-third-st.

Clinton, Ind.—(Special.)—J. Clark Smith, cy. clk., says that bids will be asked about July 1 for 10 mis. of concrete sidewalks.

Chicago, Ill.—The property-owners of Twenty-second and Robey-sts., between Ashland and Fortieth-ave., 3 mis., are in favor of brick paving.

Tacoma, Wash.—The committee on streets and alleys have recommended asphalt paving for E-st., from Ninth to Seventeenth.

Freeport, Pa.—The question of increasing the borough indebtedness for grading, paving and sewers has been favorably voted on.

Irwin, Pa.—This town voted June 6 to increase the borough debt $50,000 for paving 4½ miles of the principal streets.

Pasadena, Cal.—The advisability of paving Fair Oaks-ave., from Union to Throop Institute, is being discussed by the city council.

Hamilton, O.—A petition is being circulated for asphalt block, brick and macadam paving on Heaton-st. L. A. Dillon, cy. eng.

Mt. Sterling, Ill.—(Special)—Hon John M. Murphy, mayor, says this city contemplates paving two blocks of streets with brick this summer.

Oneonta, N. Y.—This town voted June 17 to issue $37,500 bonds for constructing 34,000 sq. yds. of brick paving. O. A. Miller, cy. engr.

Superior, Wis.—The county board passed a resolution June 19 to purchase a rock crusher and construct a system of macadamizing roads.

Vailsburg, N. J.—Ordinances have been passed for grading, curbing and sidewalks on Maple, Myrtle, Rodwell, Fifteenth and Fourteenth-ave.

Waukegan, Ill.—A resolution is pending which provides that all the new walks shall be of brick, stone or cement. Mayor Finer.

Helena, Mont.—(Special)—Hon. T. J. Edwards, mayor, says that bids will probably be asked before Nov. 1 for ¾ mi. of brick or granite paving.

Washington, Ia.—The sidewalk committee has been instructed to build a cement sidewalk on the county ground west of the city hall. Mayor Wilson.

Erie, Pa.—An ordinance has been passed for paving Twelfth and Twenty-first-sts., from Peach to Sassafrass, with brick. C. A. Gaither, clk. com. coun.

Cedar Rapids, Ia.—The bids received May 31 for asphalt paving in certain streets have been rejected, according to press reports, and new bids will be asked.

Kewanee, Ill.—Objections to the proposed vitrified brick pavement on Tremont and

Prospect-sts. will be heard June 29. J. E. Shepardson, cy. engr.

Peoria, Ill.—The improvement board set June 29 to hear objections to the proposed brick pavement in St. James-st., from Elizabeth to Institute Place.

Bridgeport, Ill.—The village clerk has been instructed to procure prices on paving brick from different manufacturers. J. W. Deisher, vil. clk.

Indianapolis, Ind.—B. J. T. Jeup, city engineer, has been directed to prepare papers for paving Washington-st., from Belmont-ave. to Fall creek, with brick.

Buffalo, N. Y.—The taxpayers of the 21st ward have petitioned the common council to resurface Tupper-st., from Delaware-ave. to Virginia-st., with asphalt.

Traverse City, Mich.—(Special)—Frank Hamilton, chm. st. com., says this city is making preparations to pave early next year. O. P. Carver, chm. B. P. W.

Boone, Ia.—(Special)—Jesse L. Hull, cy. clk., says that about 2 blocks of brick paving on concrete is contemplated for 1901, and 10 blocks for 1902.

Los Angeles, Cal.—The question of paving W. Seventh-st., from Central-ave. to Union-ave., a distance of 2 miles, with asphalt on concrete base, is being considered.

Laporte, Ind.—The question of constructing macadam roads in this city and in Center and Springfield twps., was favorably voted on June 18. F. H. Dofan, audt.

Celina, O.—A petition for paving W. Fayette-st. with brick has been granted. Asphalt paving has been petitioned for on W. Market-st. Cy. Engr. Lutz.

Baraboo, Wis.—Ordinances are pending for a sidewalk on Camp-st., from Second to Fifth-st., and for paving Ash-st., from Fourth to Eleventh. Mayor McFetridge.

Laurium, Mich.—The sum of $100,000 for public improvements, including macadam paving for Linden-ave. and an extension of the sewerage system has been appropriated.

Havana, Cuba.—The government rejected the bid of Dady, Onderdonk & McLellan for paving and sewering this city, and will readvertise the contract for three months.

Iowa City, Ia.—Final action on the resolutions to pave College-ave. and Market-st. with brick has been deferred until July 12. Cy. Engr. Magowan, Mayor Stubbins.

Michigan City, Ind.—The committee on sidewalks and crossings has recommended the construction of sidewalks on the south side of Michigan-st. E. J. Heise, cy. clk.

Champaign, Ill.—An ordinance has been passed to pave Green-st., from State-st. to Prospect-ave., with brick on a broken-stone foundation. C. D. Stevens, cy. clk.

Moline, Ill.—The improvement board has decided to recommend ordinances for asphalt paving on Twenty-second-st. and brick paving on Second-ave., from Fifteenth to Seventeenth, and for two alleys.

St. Paul, Minn.—The alley in the block bounded by Mackubin-st., Ashland, Holly and Portland-ave. will be paved with block; macadam paving is proposed for Summit-ave., from Dale to Lexington.

Paducah, Ky.—(Special.)—The Hon. J. L. M. Lang, mayor, says that many miles of interurban gravel roads will be built. The date for receiving bids will be fixed on final passage of the ordinance.

Los Angeles, Cal.—The construction of 6-ft. walks on both sides of Second-st., from Bolston-ave. to Figueroa-st., is desired by the property owners. Mayor Snyder.

Kenosha, Wis.—(Special.)—Gus Jacobs, cy. clk., says about 34,536 sq. yds. of vitrified brick paving, 8,650 lin. ft. of curb, and 11,500 cu. yds. of excavation is contemplated.

Lowell, Mass.—The committee on streets has voted to secure an estimate for paving Middlesex and Branch-sts. with asphalt. The construction of concrete walks in certain streets is proposed.

Hamilton, O.—Plans and specifications for paving E. High-st., from Fourth-st. to the C., H. & D. R. R. and B-st., from Main-st. to Ross-ave., have been submitted by L. A. Dillon, cy engr.

Wellington, Kas.—Specifications for rebuilding and repairing the sidewalks of Main-st., have been filed by City Engineer Roberts. Ordinances were passed June 11 requiring the construction of brick sidewalks where walks have been condemned by the council.

Sioux City, Ia.—A resolution has been passed to pave Douglas-st., from Sixteenth to Eighteenth with asphalt. A petition for asphalt paving on Nebraska-st., from Twelfth to Twenty-fifth, has been referred to the paving committee.

Birmingham, Ala.—Ordinances have been passed for paving Avenue J, from Nineteenth to Twentieth, with brick, and for macadamizing Third and Seventh-aves. and Avenue F. W. M. Drennen, mayor. H. D. Wood, cy. clk.

Mansfield, O.—The improvement of Bowman-st. with brick and flagstone walk on both sides is contemplated. A resolution has been adopted to pave Orchard-st., from Main to Maud, with brick. Cy. Engr. Laird.

Houston, Tex.—Plans and specifications for asphalt, brick and macadam paving for Congress-ave., Preston, Hardy, Prairie, Franklin, Travis, Commerce, Leeland, Henier, Sabina and Odin-sts. have been presented to the board of public works.

Lafayette, Ind.—An ordinance has been adopted for building cement walks on Salem-st., between Seventeenth and Eighteenth-sts. A cement walk has been petitioned for in Purdue-st., between Main and Sixteenth. Mayor Justice.

Jeffersonville, Ind.—(Special.)—Victor M. Lyon, cy. engr., says plans and specifications are being made and bids will be asked soon for the reconstruction of about four miles of granitoid sidewalks and brick gutters. Mayor Rader.

Winnipeg, Man.—The council has decided to pave Assiniboine-ave., from Donald to Main-st., with asphalt; Logan-ave., from Princess to Ellen, with cedar blocks; Spencer-st., boulevarding and sidewalks; macadam roadways in certain streets. C. J. Brown, cy. clk.

Mankato, Minn.—The city council condemned a large number of old sidewalks June 7, and will now consider a proposition made by Fred J. Warren of Boston for constructing kiolithic stone walks. Mr. Warren visited this city June 22, on invitation of the city council, to explain the advantages of this paving.

CONTRACTS TO BE LET.

Sullivan, Ind.—Sealed bids are asked until July 5 for building over 7 mls. of gravel roads in Fairbanks twp. Co. audt.

Des Moines, Ia.—Sealed bids are asked until July 5 for 4,332 sq. yds. of brick paving. G. A. Eberhart, chm. B. P. W.

Missoula, Mont.—Bids are asked until July 16 for constructing a road from Salstese east up the canyon. H. F. Wilkinson, co. clk.

Scottdale, Pa.—Sealed bids are asked until July 17 for 14,184 sq. yds. of brick paving, 8,400 lin. ft. of curbing, etc. E. L. Rutherford, boro. secy.

Van Wert, O.—Sealed bids are asked until July 8 for paving Elm-st. with brick, and for macadamizing portions of Shaffer, Calle and Burt-sts. H. C. Redrup, vil. clk.

Worthington, Minn.—Sealed bids are being asked by the county commissioners for building a cement walk and curb on two sides of the court house square, 6-ft. wide and 660 ft in length. E. A. Tripp, co. audt.

St. Louis, Mo.—Sealed bids are asked until 12 m., July 9, for grading certain alleys and paving certain streets with brick on concrete base. Hiram Phillips, chm. bd. pub. impvts.

Albany, N. Y.—Sealed bids are asked until 12 m. July 2 for improving 49 miles of public highways, and for improving 1¾ miles of road No. 47. Edward A. Bond, state engr. and surv.

Rockport, Ind.—Sealed bids are asked until 6 p. m. July 8 for constructing ten separate roads, comprising 22,675 miles of macadam road. Geo. J. Clement, John G. Rimstidt.

New York City—Sealed bids are asked until 11 a. m. July 2 for repaving with asphalt on concrete base portions of 25 streets in the borough of Brooklyn. Dept. of highways.

Marysville, O.—Sealed bids are asked until 8 p. m. July 25 for brick paving on concrete foundation, including stone curbing, etc., on W. Sixth-st., from the east line of Maple-st. to the west line of Maple-st. J. C. Kennedy, cy. engr.

Toledo, O.—Sealed bids are asked until 12 m. July 8 for paving Parkwood-ave. and Nevada and Milton-sts. with asphalt, asphalt blocks, brick or vitrified blocks or Kreodone creosoted wooden blocks. J. E. Connell, cy. clk.

Sparta, Wis.—Sealed bids are asked until 2 p. m. July 6 for macadamizing streets, including the following: 2,592 yds. cut and 304 yds. fill, 10,000 lin. ft. combined curb and gutter, 4,373 lin. ft. of 30-ft. street, and 549 ft. of 42-ft. street. Cy. clk.

Dayton, O.—Sealed proposals are asked until 12 m July 3 for paving Richard-st., from Parrott-st. to Linden-ave., with brick, as follows: Paving, 3,000 sq. yds.; curbing, 3,300 lin. ft.; circular curbing, 223 lin. ft. G. F. Kuhns, pres. bd. cy. affairs.

Omaha, Neb.—Sealed bids are asked until 2 p. m. July 5 for paving, repaving, curbing, recurbing and guttering about 45 streets. The paving material will be asphalt, vitrified brick, stone block, vitrified block or disintegrated granite. Andrew Rosewater, chm. B. P. W.

CONTRACTS AWARDED.

Des Moines, Ia.—O. P. Herrick was awarded the contract for paving Eighth-st. with brick, $1.58 a sq. yd.

Shreveport, La.—The bids received June 5 for asphalt paving averaged $2.40 a sq. yd., and on brick $2.10.

Lima, O.—The contract for paving W. High-st., from Main to Cole was awarded to Spyker, Milligan & O'Brien.

Crawfordsville, Ind.—The contract for 29,800 sq. yds. of paving was awarded to D. W. Norton & Co., of Terre Haute for $50,000.

Shreveport, La.—The contract for paving Sprague-st. with brick was awarded June 11 to J. L. Cabot at $2.10 a sq. yd.

Erie, Pa.—Mayer Bros. secured the contract June 10 for paving Fourth-st., from Walnut to Cherry with Park brick at $1.68½ a sq. yd.

Kentland, Ind.—The contract for constructing roads in Grant twp. has been awarded to the William Heffron company of Cincinnati for $45,412.

Bridgeport, Conn.—The contract for laying 4,500 sq. yds. of brick paving has been awarded to Silliman, Godfrey & Co., at $1.45 a sq. yd.

New Martinsville, W. Va.—Collsworth Skidmore of Parkersburg was awarded the contract May 29 for brick paving in this city for $19,000.

Rochester, N. Y.—The Rochester Asphalt Pavement company was awarded the contract June 14 for an asphalt mastic sidewalk on Mt. Hope-ave. for $3,552.

Duluth, Minn.—The contract for paving Superior-st. was awarded to Watterworth & Fee of this city for $45,700. Purington paving brick will be used.

Cohoes, N. Y.—The contract for paving Grant-st. with asphalt, from Youngloveave. to a point 175 ft. southerly, was awarded June 12 to the New York Bermudez company for $5,599.52.

Chester, Pa.—The contract for constructing the asphalt walk and pavement on the Ninth-st. bridge was awarded June 18 to the Vulcanite Paving company of Philadelphia for $650.

Oskaloosa, Ia.—The contract for paving S. Seventh-st. and Third-ave. was awarded as follows: Exca., 14 cts. a cu. yd.; brick on sand, $1.39 a sq. yd.; curbing, 32 cts. a lin. ft.

Scranton, Pa.—The contract for building stone walks in parts of N. Main-ave. and Providence road was awarded June 12 to C. L. Teeter at 14 and 13 cts. a sq. ft., respectively.

Rushville, Ind.—Oglesby & Kelly secured the contract for building cement walks on Eighth-st. at 15 cts. a sq. ft.; 40 cts. a lin. ft. for curbing; 25 cts. a lin. ft. for gutters.

Binghamton, N. Y.—The lowest bid submitted for paving State and Susquehanna-sts. was that of A. L. Willey at $1.99. The bids were rejected and the clerk directed to readvertise for bids.

LaCrosse, Wis.—R. F. Weston was awarded the contract for macadamizing State and Main-sts. for $1,000. E. S. Mead & Co. of Chicago secured the contract for paving West-ave. for $34,580.

Sheboygan, Wis.—John Braun of this city was awarded the contract for 10,232 sq. yds. of paving at 93 cts. a sq. yd. and 4,400 ft. of combined curb and gutter at 53 cts. a lin. ft.; total, $12,402.

Minneapolis, Minn.—The Purington Paving Brick company of Galesburg, Ill., was awarded the contract for furnishing brick

and cedar blocks for paving Sixth-st. N., and Third-ave. N., at $17 per 1,000.

Oswego, N. Y.—The contract for paving E. Bridge-st., from the Hydraulic canal to E. First-st., 660 sq. yds., was awarded June 10 to John Henrick at $3.45 a sq. yd. for paving and 80 cts. a lin. ft. for curb.

Duluth, Minn.—The contract for building all cement walks built under city contract was awarded June 14 to Dixon & Lowry at 18 cts. a sq. ft. for tile or granolithic walks when in front of property and 23 cts. a ft. for corners.

Davenport, Ia.—The Davenport Construction company was awarded contracts June 18 for eleven blocks of brick paving as follows: Iowa-st., $1.27½ a sq. yd.; Eighth-st., $1.28½; Second-ave., $1.30; Third-ave., $1.31; alley, $1.30.

Louisville, Ky.—Asphalt paving contracts were awarded June 11 as follows: Second-st., from Magnolia to Burnett-ave., and Magnolia-ave., from Third to Fourth-st., the Parks company; Brook-st., from Oak-st. to Ormsby-ave., Green River Asphalt company.

South Bend, Ind.—The contract for 16,000 sq. yds. of brick paving has been awarded to Robert Hoban & Roach at $1.17 a sq. yd. for Indiana repressed brick; 15 cents a cu. yd. for grading, 20 cents a lin. ft. for cement curbing; total, $20,984.

Shreveport, La.—Contracts for asphalt street paving have been awarded, according to press reports, as follows: Uvalde Asphalt company, 9 streets, 57,750 sq. yds., $2.19 a sq. yd.; Southern Paving and Construction company, 2 streets, 29,617 sq. yds., $2.39.

Independence, Mo.—(Special.)—H. H. Pendleton, cy. engr., says the contract for brick paving was awarded to Chapin & Greever at $1.62 a sq. yd. John E. Lewis was awarded the contract for 10,400 ft. of artificial stone curbing at 44 cents a lin. ft.

Janesville, Wis.—(Special.)—C. V. Kerch says that the contract for improving Clark-st. has been awarded to James Cape & Sons of Racine at 55½ cents a sq. yd. for macadam; 67½ cents a lin. ft. for combination curb and gutter; 37 cents a cu. yd. for excavating.

Ft. Wayne, Ind.—Bids were received June 3 for paving Hanna-st. The Barber Asphalt company bid $7.40 to $7.46 a lin. ft. for asphalt, while the bids for brick were from $7.51 to $7.64 a lin. ft. The award was not made, but taken under consideration.

Bay City, Mich.—The contract for paving Second-st., from Water to Washington, with brick was awarded to R. Ryan at $1.98 a sq. yd., including curbing, and $2.28 a sq. yd. for intersections, including circular curbing for corners, side drainage and catchbasins.

Grand Rapids, Mich.—Albert Prange secured the contract June 18 for macadamizing Fountain-st., from S. Davidson to S. Lafayette, for $7,287. The contract for graveling and grading Queen-st., from Quimby to Sweet-st., was awarded to Thomas P. McDermott for $3,295.

Milwaukee, Wis.—The Western Paving and Supply company was awarded contracts June 18 for paving portions of Jackson, Sycamore, Wells and Eleventh-sts. and Ogden-ave. with asphalt at $2.23 a sq. yd. Barber Asphalt Paving company was awarded the contract for Grove-st. and Eleventh-ave.

Cedar Rapids, Ia.—R. F. Conway & Co. secured the contract May 31 for asphalt paving at $1.65 a sq. yd.; combined curb and gutter, 30 cents a lin. ft.; setting curb, 20 cents a lin. ft. The Western Paving and Supply company bid $1.66 and the Barber Asphalt Paving company $1.90 a sq. yd. for paving.

Utica, N. Y.—The contract for paving York-st., from Court-st. to State hospital entrance, 4,040 sq. yds., was awarded to the Interstate Paving company at $2.44 a sq. yd., or $9,887.20. W. W. Fowler was awarded the contract for paving Washington-st., from Lafayette-st. to the Erie Canal, 1,040 sq. yds., for $3,078.50.

Galesburg, Ill.—J. R. Inness was awarded the contract for paving two streets with brick, as follows: 10,450 sq. yds. single-course brick paving, 90 cts. a sq.yd.; stone corners, 2 ft. radius, ¼ circle, $2.65; stone corners, 5 ft. radius, ¼ circle, $7.50; 5,750 ft. straight stone curb, 43 cts.; 4,875 cu. yds. earthwork, 16 cts.; total, $12,990.

Parnassus, Pa.—Contracts for 24,850 sq. yds. of brick paving have been awarded to Jos. Maloney and T. J. Rosser of Bellaire, O., as follows: brick paving on gravel foundation, $1.03; on stone, $1.12; earth exca., 10,000 cu. yds., 24 cts.; new curb on concrete, 55 cts.; on gravel, 45 cts.; curb reset, 10 cts.; rough curb, 40 cts.; total, on gravel foundations, $28,341.

Camden, N. J.—The Vulcanite Paving company was awarded the contract, June 11, for repaving with asphalt Third-st., from Kaiglin-ave. to State-st., and Second-st., from Federal to Arch, at $2.30 a sq. yd. The bids for Second-st., from Market to State, were laid over because the funds for the work were not available at present. The price paid the Vulcanite company under former contracts was $2.55. The Pennsylvania Asphalt company bid $2.37 a sq. yd. on the above work.

Petaluma, Cal.—(Special.)—N. S. Frost, cy. engr., says that J. R. Nesbett has been awarded the contracts as follows: Second-st., exca., 24 cts. a cu. yd.; filling, 22½ cts. a cu. yd.; basalt block curbing, 13½ cts. a lin. ft.; paving gutters, 6 cts. a. sq. ft.; macadamizing, 3½ cts. a sq. ft.; box culverts, $13.75 each. A-st., exca., 26 cts. a cu. yd.; plank curbing, 11½ cts. a lin. ft.; paving gutters, 6½ cts. a sq. ft.; macadamizing, 3¾ cts. a sq. ft.

Utica, N. Y.—The Interstate paving company was awarded contracts June 14 for asphalt paving as follows: Whitesboro-st., from Genesee to Washington-st., $5,694.40; Columbia-st., from Genesee to Cornelia, $4,988.50, repairing asphalt streets on which guarantee has expired, $1.90 a sq. yd. for repairing, resurfacing, $1.35; new pavement with low stone filling, $1.60; total, $3,795. The Barber Asphalt Paving company was awarded the contract for repaving Seneca-st., from Lafayette to 100 ft. north of Liberty, for $5,244.50.

Detroit, Mich.—The contract for paving Cass-ave. with asphalt was awarded, June 3, to the Trinidad-Bermudez company. Other contracts were awarded as follows: Field-ave., cedar on concrete, Wm. Sappin, $1.13 a sq. yd.; National-ave., cedar on con-

crete, W. E. Lennane, $1.30; Fifth-st., cedar on concrete, Thomas J. Kennedy, $1.35; Beaubien-st., cedar on concrete, $1.34. Bids were received June 12 for brick repaving, the lowest being $1.87 a sq. yd., which was considered too high. The bid of James Grant for paving Franklin-st. with brick at $1.71 may be accepted.

Buffalo, N. Y.—Bids were received June 7 for repaving seven streets, the lowest bidders being as follows: Clinton-st., Warner-Quinlan company, asphalt, $1.24; H. P. Burgard, brick $1.83. Michigan-st., H. P. Burgard, $1.49 for asphalt and $1.88 for brick. Tupuer-st., H. P. Burgard, $1.49 for asphalt or brick. Indiana-st., H. P. Burgard, $1.49 for asphalt and $1.76 for brick. Morgan-st., H. P. Burgard, $1.47 for asphalt and $1.77 for brick. Bond-st., Interstate Paving company, $1.23 for asphalt; John Munn, $1.86 for brick. Carolina-st., H. P. Burgard, $1.47 for asphalt and $1.71 for brick. The reduction in the asphalt bids amount in all to about $21,000 over those previously received.

Syracuse, N. Y.—Paving contracts were awarded June 1 as follows: Asphalt—Gifford-st., Warner-Quinlan Asphalt company, $41,055; Harrison-st., Empire Contracting company, $3,115.50; Leavenworth-ave., Contracting company, $6,819.10; Lincoln-ave., Warner-Quinlan Asphalt company, $8,265.50; N. Alvord-st., Empire Contracting company, $3,456.85; S. Warren-st., Barber Asphalt Paving company, $1,101.80; Walton-st., Empire Contracting company, $12,974.85. Brick—Canal and Pearl-sts., F. J. Baker & Co., $5,719.50; Euclid-ave., Gleasin-Kiely Contracting company, $33,553.50; N. West, Wallace and Mechanic-sts., $9,364; Pearl-st. and public market place, $8,706.20; W. Belden-ave. and Wallace-st., $21,018; W. Fayette-st., $9,018, and W. Jefferson-st., $19,455, F. J. Baker & Co.

Toronto, Ont.—(Special.)—The contract for paving was awarded May 29 to the Dominion Paving and Contracting company, as follows: King-st., Bathurst to Strachan-ave., $19,593; King-st., from Strachan-ave. to Armour-st., $10,595; Wellington-st., from Peter to Clarence-square, $2,089. The company will use land asphalt. The other bidders were as follows: King-st., Bathurst to Strachan-ave., Constructing and Paving company, $21,493; Barber Asphalt Paving company, $21,986; city engineer, $23,220. King-st., from Strachan-ave. to Armour-st., Constructing and Paving company, $13,300; Barber Asphalt Paving company, $13,029; city engineer, $13,300. Wellington-st., from Peter to Clarence-square, Constructing and Paving company, $2,300; Barber Asphalt Paving company, $2,222; city engineer, $2,205.

SEWERS.

CONTEMPLATED WORK.

Birrabik, Minn.—A sewerage system is needed.

Batavia, N. Y.—A new sewerage system is proposed.

Swampscott, Mass.—A sewerage system is proposed.

Hudson, Mass.—A sewerage system is contemplated.

North Platte, Neb.—A sewerage system is contemplated.

Appleton, Wis.—A sewer has been ordered built on Summer-st.

Lowell, Mass.—The construction of filter beds is proposed.

Beaver, Pa.—Bids will probably be asked for building new sewers.

Waseca, Minn.—The construction of a sewerage system has been suggested.

Luling, Tex.—The city council has decided to build a sewerage system.

West Springfield, Mass.—Plans are being prepared for the Riverdale trunk sewer.

Healdsburg, Cal.—A survey of this city for a sewerage system has been ordered.

Mohawk, N. Y.—A sewerage system is proposed by the village board of trustees.

Grand Island, Neb.—An ordinance has been passed creating a new sewer district.

Newark, O.—Contracts will probably be let soon for 3,000 ft. of sewer construction.

Hyde Park, Vt.—The question of building a sewerage system will be voted on in July.

Reading, Pa.—The construction of two large concrete storm water sewers is contemplated.

Oshkosh, Wis.—A resolution was passed, June 11, to lay another Main-st. relief sewer.

Albany, N. Y.—An ordinance has been passed to build a vitrified stoneware sewer in Seneca-st.

Adrian, Mich.—The question of issuing $5,600 bonds for sewers was voted on June 29.

Caro, Mich.—Estimates will be secured of the cost of building a complete sewerage system.

Herkimer, N. Y.—A resolution has been adopted to build a sewerage system. Vil. bd. of trustees.

East Orange, N. J.—The construction of storm water drains in the Third, Fourth and Fifth wards is proposed.

Grinnell, Ia.—A resolution is pending for a sewer in Sixth-ave. H. W. Spaulding, mayor. J. F. Wilson, clk.

Baraboo Wis.—Plans and specifications for a sewer on Sixth-ave. have been adopted. Cy. Engr. Kirchoffer.

Thief River Falls, Minn.—The council voted to employ an engineer to make plans for a sewerage system.

South Bend, Ind.—Plans for sewers in three streets are being prepared by A. J. Hammond, cy. engr.

Galion, O.—(Special)—P. O. Ross, city clerk, says that main trunk sewers are contemplated.

Plattsburg, N. Y.—A resolution has been adopted authorizing the issue of bonds for sewers and paving.

Oakland, Cal.—Estimates for a storm sewer on Adeline-st. have been prepared. Fred Turner, cy. engr.

Monmouth, Ill.—Plans for a septic tank sewage disposal system have been made by T. S. McClanahan, engr.

Norristown, N. J.—Plans for a sewage disposal system will be made by Alexander Potter, C. E., of New York City.

Zanesville, O.—Plans are being prepared for the proposed Tenth ward sewerage system. Cy. Engr. Buell.

Sheboygan, Wis.—Plans are being prepared for 2,200 lin. ft. of 48-in. brick sewer, and 1,200 ft. of pipe sewer.

Dorranceton, Pa.—This city voted June 11

to issue $33,200 bonds for the construction of a sewerage system.

Ashland, Wis.—Bids will probably be asked about July 15 for 4,000 feet of sewer construction. M. T. Dozer, cy. engr.

Boone, Ia.—G. A. Holm, chairman committee on sewerage, has recommended a sewerage system for the district west of Division-st.

Grand Island, Neb.—An ordinance has been passed creating a new sewerage district, which provides for sewerage for 15 residence blocks.

Sharon, Pa.—The question of issuing $60,000 bonds for building a complete sewerage system was favorably voted on June 15th.

Alton, Ill.—A petition has been submitted to the council asking for a 10-ft. brick sewer to be built to enclose Piasa creek.

Birmingham, Ala.—Ordinances have been adopted for sewers in certain streets and alleys. W. M. Drennen, mayor; H. D. Ward, cy. clk.

Sauk Centre, Minn.—(Special.)—J. F. Cooper, city clerk, says that it is possible that about six blocks of sewers will be laid this or next year.

Eureka, Kas.—(Special.)—J. H. Smythe, cy. clk., says that preliminary surveys have been made for sewers, but no definite action taken yet.

Marlboro, Mass.—Plans for 4,200 ft. of drain to carry off surface water from the center of this city have been prepared. Jas. F. Bigelow, cy. engr.

Louisville, Ky.—An ordinance has been passed to build a brick sewer on Floyd-st., from Burnett-ave. to the city limits, at a cost of $40,000. Mayor Weaver.

Hamilton, O.—A resolution has been passed to build a sewer and house connections on Hanover-st. and Frankfort alley. L. A. Dillon, cy. engr.

North Tonawanda, N. Y.—The board of public works has decided to expend about $6,000 in extending the sewerage system in the Ironton district.

Jeffersonville, Ind.—(Special.)—Victor M. Long, cy. engr., says plans are being prepared for 4,700 ft. of 24, 27 and 30-in. tile sewers, and bids will be asked in about 45 days. Mayor Rader.

New Orleans, La.—The plans recently prepared by General Superintendent Earl for a sewerage and water supply were unanimously adopted by the sewerage and water board June 20.

Rochester, Ind.—(Special.)—Edward E. Murphy, cy. clk., says that plans and specifications are being prepared by C. G. H. Goss, C. E., of Martinsville, Ind., for a complete sewerage system.

Paris, Ky.—(Special.)—D. C. Parrish says that the question of paving and sewers is being considered and that the contract for sewer construction will be let about July 1. The plans are not yet completed.

Medina, N. Y.—A committee has been appointed to employ a competent engineer to make surveys and maps and prepare specifications for a main trunk sewer down Orient-st. with connecting branches to Church and Shelby-sts.

CONTRACTS TO BE LET.

Paris, Ky—Contracts for sewers will be let about July 15. D. C. Parrish, chmn. com.

Belding, Mich.—Bids are asked until July 5 for a sewer in district No. 1. A. W. Pringle, cy. clk.

Iona, Minn.—Sealed bids are asked until 7 p. m. July 8 for building a sewer. John Krier, prest. com.

Akron, O.—Sealed bids are asked until 12 m. July 6 for a main trunk sewer in district No. 9. W. A. Durand, clk.

Kokomo, Ind.—Bids are asked until July 15 for 2,450 ft. of 15 and 12-in. vitrified tile sewers. Jackson Morrow, cy. engr.

New Orleans, La.—Sealed bids are asked until July 24 for constructing drainage works. R. M. Walmsley, prest. drainage comrs.

Cleveland, O.—Bids are asked until 12 m. July 9 for 2,400 lin. ft. of 13-ft. 6-in. main intercepting sewer. Chas. P. Salen, dir. pub. wks.

Spirit Lake, Ia.—Bids are asked until July 15 for 4,600 ft. of 10.8-in. pipe sewers and a sewage disposal plant. A. W. Osborn, mayor.

Houston, Tex.—Mayor Woolford has been authorized to ask for bids for constructing a sewage pumping station in the Fair Grounds addition.

Taylorsville, Ill.—Bids will be opened at 12 m. July 10 for furnishing large quantities of drain tile for district No. 1. J. W. Dappert, engr.

Michigan City, Ind.—Sealed bids are asked until 5 p. m. July 8 for constructing sewers in Boston and Michigan-sts. and two alleys. Edward J. Heise, cy. clk.

St. Louis, Mo.—Sealed bids are asked until 12 m. July 9 for building brick and pipe sewers in a large number of streets. Hiram Phillips, prest. B. P. I.

Haddonfield, N. J.—Sealed bids are asked until 4 p. m. July 15 for constructing a sewerage system and a sewage disposal. J. Morris Roberts, mayor; H. M. Boroughs, clk.

Lebanon, Ind.—Sealed bids are asked until 12 m. July 12 for constructing 18 mis. of 8 and 24-in. sewers. Wm. H. King, chmn. ditches and sewer com. John W. Fulwider, cy. engr.

Port Clinton, O.—Sealed bids are asked until July 6 for the improvement of sewer district No. 8 by the construction of a main trunk sewer in Sixth-st. Wm. Clearer, cy. clk.

Woodbury, N. J.—Sealed bids are asked until 8 p. m. July 9 for a sewerage system consisting of 66,000 ft. of vitrified pipe; 157 manholes; an inverted siphon, and a concrete reservoir. D. T. Mathers, cy. clk.

Visalia, Cal.—Bids are asked until Aug. 10 for constructing 19 mis. of 6 to 18-in. pipe sewers, to include a pumping plant, screening chamber, septic tank, filtration system. L. E. McCabe, engr.; M. F. Byrnes, cy. clk.

Mansfield, O.—Sealed bids are asked until 12 m. July 13 for a tile drain main sewer from the siphon chamber in Strawberry alley to Ritter-st., and for tile drain submain sewers Nos. 1, 2, 3 and 4, in sewer dist. No. 4 F. M. Remy, cy. clk.

Cambridge, O.—Sealed bids are asked until 12 m. July 13 for the extension of the sewerage system, comprising the following: 16,018 ft. of 8 and 5-in. sewer pipe; 1,256 cu. yds. rock exca., 55 cu. yds. concrete, 19 manholes, 7 flushtanks. T. R. Deselm, cy. clk.

CONTRACTS AWARDED.

Shenandoah, Ia.—The contract for a sewer was awarded to Dunnegan & Sullivan.

Le Mars, Ia.—John Evans was awarded the contract for a sewer from Western Union College to Main-st.

Davenport, Ia.—The contract for a sewer on Esplanade-ave. was awarded June 19 to Patrick Conelly.

Blue Earth, Minn.—The contract for building a sewer was awarded to E. I. P. Staede of Mankato for $4,800.

Portland, Ore.—Smyth & Howard secured the contract June 6 for a sewerage system in Beech-st. for $54,382.

Sheboygan, Wis.—The contract for a sewer in N. Eighteenth-st. was awarded June 1 to William Schaetzer for $14,308.

Pittsfield, Mass.—The Troy Public Works company was awarded the contract for sewers in dist. No. 8 for $41,611.

Decatur, Ala.—The contract for building the sewerage system was awarded to Guild & Co. of Chattancoga, Tenn., for $28,500.

Brooklyn, N. Y.—The contract for a trunk sewer in the Bay Ridge section was awarded June 5 to Thomas Wade for about $800,000.

Joplin, Mo.—The contract for building a sewer in the S. Joplin district has been awarded to the Joplin Sanitary Plumbing company at $1.12 per lin. ft.

Marshall, Mich.—The contract for a sewer in State-st. was awarded June 17 to W. M. Michel & Son of Gray's Lake at 55 cents a ft., and $25 for manholes.

St. Paul, Minn.—Sewer contracts were awarded June 10 to Christ Johnson as follows: Mississippi and Cayuga-sts., $6,840; Farrington-ave., $163; Greenwood-ave., $237.50.

Scranton, Pa.—Fickers & Partridge secured the contract for 2,722 ft. of 8 to 15-in. pipe sewer, with 23 manholes and 5 catch basins at $1.47½ a lin. ft., complete.

Petaluma, Cal.—(Special.)—N. S. Frost, cy. engr., says that J. R. Nesbett was awarded the contract for the 6-in. pipe sewer at 44½ cts. a lin. ft. and $11 for lampholes.

Grand Rapids, Mich.—The contract for sewers in S. Division-st., Central and First-aves. and Pleasant-st. was awarded June 18 to Richard Pickett for $9,820; sewer in Canier-st., John J. Rens, $1,114.

Salt Lake City, Utah.—The W. P. Glann Construction company of Chicago was awarded the contract Jan. 10 for laying sewers for $13,275. The Red Wing Pipe company of Red Wing, Minn., was awarded the contract for the material for $4,163.68.

Cedar Rapids, Ia.—Ford & Delahunt were awarded the contracts for storm water sewers as follows: Fifth-st., $11,041; Bever Park, $37,813; Vinton ditch, $40,350; Thirteenth-ave. and J-st., $13,563.

Indianapolis, Ind.—The contract for building the E. Michigan-st. sewer will probably be awarded to H. A. Mansfield, whose bid of $7.46 a lin. ft. was the lowest. The total bid was $88,923 and the engineer's estimate was $95,000.

Syracuse, N. Y.—Sewer contracts were awarded June 10 for four sewers as follows: Bridge, Williams and Erie-sts., Martin Lavelle, $4,360.20; Manlius and Highland-sts., Gleason-Kiley Constructing company, $2,668; Marcellus-st., John W. Bustin, $1,827; Willis-ave., Gleason Kiely Contracting company, $653.55.

WATER-WORKS.

CONTEMPLATED WORK.

Austin, Minn.—An increased water supply is proposed.

Fairmount, W. Va.—Plans for a water works system have been completed.

St. Joseph, La.—The question of extending the water works will be voted on July 17th.

St. Joseph, Mo.—Water mains are proposed for a number of streets.

Moultrie, Ga.—The question of extending the water works system will be voted on.

Jeffersonville, N. Y.—Surveys for water works have been made.

Parkersburg, W. Va.—A filtration system is proposed.

Hopkinton, Mass.—The extension of the water mains is proposed.

Caldwell, Idaho—City Engineer Heddin has prepared two plans for the proposed water works system.

Dwight, Ill.—The estimated cost of constructing a water main in Chippewa-st. is $1,200.

Lynchburg, Va.—The water committee is considering the construction of a filtration plant.

Ann Arbor, Mich.—The common council has voted to expend $500 for an expert estimate of the present value of the water works system.

Fremont, O.—The question of issuing $35,000 bonds for improving the water works will be voted on July 11th.

Cripple Creek, Col.—Plans for a new reservoir have been accepted by the city council. City Engr. Bodfish.

Preston, Minn.—The extension of water mains is contemplated. A. W. Thompson, mayor.

Toledo, O.—Swan creek is being considered as a source for a pure water supply for this city.

Tullahoma, Tenn.—Bids will be asked soon for building water works and electric light plant.

Sault Ste. Marie, Mich.—The extension of the water mains on Seymour and Derry-sts. is contemplated.

Columbus, O.—The board of public works has decided to ask for bids for iron pipe varying in size from 6 to 24 ins.

Madison, Wis.—The extension of the water mains across the Yahara river to North-ave. has been decided upon.

Hempstead (L. I.), N. Y.—The question of purchasing the water plant for $5,000 will be voted on July 2.

Carbondale, Ill.—Fred Richart has been employed to investigate construction of water works and electric light plants.

La Crosse, Wis.—An ordinance has been adopted providing for the issue of $25,000 bonds for water main extensions.

Missouri Valley, Ia.—The extension of the water works system to Willow Park addition is proposed.

Lafayette, Ind.—Plans have been approved for the new auxiliary water works pumping station to be erected in Columbian park.

Dexter, Me.—This town will engage an engineer to prepare plans for a water works. C. M. Sawyer, chm. of committee.

Question of issuing bonds for building water works will be voted on as follows: North English, Ia.; Pine Island, Minn.; Englishtown, N. J., July 9.

Washington, D. C.—Plans and specifications for a pumping station, to cost $250,000, have been prepared by Henry Braums of Baltimore, Md.

Newcomerstown, O.—This town is considering a proposition of J. H. Beal of Scio and S. F. Potter of Greensburg to build water works.

Philadelphia, Pa.—Plans and specifications for a filter plant at Forresdale will be submitted soon, and bids will probably be opened soon.

New Haven, Conn.—Water purification is under consideration, and George W. Fuller, M. Am. Soc. C. E., has been engaged to examine and report on the subject.

Helena, Mont.—(Special.)—Hon. F. J. Edwards, mayor, says that litigation is pending regarding the proposed new water works, but the city expects to open bids about September.

The question of issuing bonds for building water works has been favorably voted on at the following places: Park River, N. D.; Florence, S. C., and Sanford, N. C.

Hartford, Conn.—The water board voted to employ an expert engineer to investigate the feasibility of filtering Connecticut river water, to be used as supplementary supply.

The construction of water works systems is contemplated at the following places: Russellville, Ky.; Glendive, Mont.; Ruthven, Ia.; Mantua, O.; Bunker Hill, Ill.; Winters, Cal.; North Plainfield, N. J.; Hamlet, N. C.

Pontiac, Mich.—The question of securing an expert engineer to ascertain if veins of water can be found at a higher level than those at present supplying the city with water is being considered.

Chicago, Ill.—Commissioner of Public Works Blocki has formulated a plan for the temporary relief of the citizens of Washington Hights and West Pullman, which involves an expenditure of $127,000.

Ft. Worth, Tex.—Daniel W. Mead, C. E., Chicago, estimates the cost of procuring an artesian water supply at $94,000, of which sum $30,000 is for tunnels, $25,000 for machinery, $15,000 for a shaft and $15,000 for a reservoir.

CONTRACTS TO BE LET.

Jasper, Minn.—Bids are asked until July 9 for water works. E. E. Humphrey, vil. recorder.

Hattiesburg, Miss.—Bids are asked until July 2 for building water works. C. W. Rich, mayor.

Amery, Wis.—Bids are asked until July 3 for a water works system. J. F. Snyder, vil. clk.

Armour, S. D.—Bids are asked until July 2 for sinking a 6-in. artesian well, the town to furnish the pipe. John S. Bean, twp. clk.

Grinnell, Ia.—Bids are asked until July 11 for sinking an artesian well 2,100 ft. deep. J. C. Goodrich, supt. W. W.

Boston, Mass.—Sealed bids are asked until 2:30 p. m. July 9 for building a reservoir in Stoneham. Henry H. Sprague, chmn. met. water bd.

Indianapolis, Ind.—Sealed bids are asked until 10 a. m. July 2 for a water softening plant for the Marion co. power house. Jas. E. Green, chmn. co. coms.

Reading, Pa.—Sealed bids are asked until 7:30 p. m. Aug. 6 for erecting a 3,500,000-gal. filter plant of a design to be submitted by the bidder. Geo. H. Felix, prest. bd. water comrs.

Wilkinsburg, Pa.—Sealed bids are asked by the Apollo W. W. Co. for building an extension to the present water system, consisting of collecting reservoir, dam, filter beds, clear water well, pump house, distributing reservoir and about 5-mis. of 12-in. main. Jas. H. Harlow, prest. Apollo W. W. Co.

Kokomo, Ind.—(Special.)—A franchise will be granted July 1 for the construction of an up-to-date water works plant. The plant is to be constructed substantially according to plans prepared by the city and to be acquired by the city after its completion for an agreed price. Jackson Morrow, cy. engr.

CONTRACTS AWARDED.

Tillamook, Or.—H. J. Wathey has been granted a franchise for a water works system.

Ft. Atkinson, Wis.—The contract for laying mains was awarded to Peter Galloway for $20,000.

Colorado Springs, Col.—The contract for extending the water mains was awarded to C. P. Quinlan & Co.

Jefferson, Wis.—A franchise for a water works system has been granted to J. H. Brown of Chicago.

Ripon, Wis.—W. W. Wheeler of Beloit was granted a franchise for water works, electric light and heating June 9.

Tell City, Ind.—The lowest bids submitted for a franchise for water works was that of H. D. Hallett of Aurora, Ill., for $44,800.

Newcomerstown, O.—A franchise for water works has been granted J. H. Beal of Scio and S. F. Dotter of Greensburg, Pa., for less than $50,000.

Binghamton, N. Y.—The contract for constructing a filter plant was awarded June 20 to the Norwood Engineering company of Florence, Mass., for $41,475.

Poughkeepsie, N. Y.—The contract for building water mains on Carroll and Cherry-sts. and Hooker-ave. was awarded to Patrick Brophy for $868.80.

Fortville, Ind.—J. K. Fatout of Indianapolis and Q. A. Wright of this town have been granted a franchise for a water works and electric light plant for this place.

New York City—The contract for laying water mains in Eighth, Park and other avenues and Sixty-ninth, One Hundred and Eighth and other streets, has been awarded to John Cornwell, jr., 69 E. One Hundred and Twenty-seventh-st.

North Grafton, Mass.—The contract for building a new reservoir was awarded June 11 to Henry W. Warren of Lee, Hiram Taylor of Northampton and G. G. Vaughn of Stanford, N. Y., for about $235,000.

BRIDGES.

Rochester, Minn.—Bids are asked until July 10 for a bridge on E. College-st.

Belview, Minn.—Bids will be received July 11 for a steel bridge at this place.

Alva, O. T.—The contract for four county bridges will be let in July. W. S. Davis, co. audt.

Clinton, Ind.—(Special.)—J. Clark Smith, cy. clk., says a stone arch bridge is contemplated.

Frederick, Md.—An iron bridge over Bush creek, near Mourana, is contemplated. Co. coms.

Arcata, Cal.—Bids for a bridge over Mad river will be received July 8 at Eureka. Super. Humboldt, Co.

Fargo, N. D.—The township board has decided to build a bridge across Wintering river, four miles northeast of the city.

South Bend, Ind.—Bids are asked until July 8 for an iron bridge across Bowman creek. J. M. Brown, co. audt.

Fenton, Mich.—The township board has ordered an election to be held July 8 to vote on the question of building the East bridge.

McConnellsville, O.—Bids are asked until July 5 for a draw bridge across the Muskingum river. F. E. Wipple, co. audt.

Hamilton, O.—Plans and specifications are being prepared for a bridge across Miami river at Woodsdale. L. A. Dillon, cy. engr.

Camden, N. J.—Plans for a new county bridge across Cooper's creek, at E. Pine-st., has been prepared by County Engineer Albertson.

Ft. Worth, Tex.—(Special.)—Sealed bids are asked until 2 p. m. July 5 for the Jennings-ave. viaduct over the Texas & Pacific railway. John B. Hawley, cy. engr.

Dayton, O.—Sealed bids are asked until 12 m. July 6 for a bridge across the Great Miami river, on Linden-ave., in Miamisburg. A. G. Foeght, co. audt.

Columbus, O.—Sealed bids will be received at this city and Lancaster, O., until July 12 for a joint bridge over Black Lick creek. L. E. Jones, co. audt.

PARKS.

West Tuxedo, N. Y.—E. H. Harriman of New York City has purchased several hundred acres of land and will improve it for a private park.

Des Moines, Ia.—A new down town park is proposed by the park commissioners.

Camden, N. J.—The question of acquiring more breathing spots is being considered.

Dunkirk, N. Y.—The purchasing committee has been authorized to purchase a number of seats for the park. F. R. Moser, pres. vil. trustees.

STREET LIGHTING.

Danville, Pa.—A committee has been appointed to secure estimates for an electric light plant.

Ambler, Pa.—A contract for street lighting for 5 yrs. has been awarded to the Montgomery Lighting company.

Hinsdale, N. H.—A 5-yr. contract for electric lights has been awarded the Brattleboro Gaslight company.

Cape May, N. J.—A 5-yr. electric light contract has been awarded the Cape May Electric company.

Omaha, Neb.—New bids for electric lighting plant will be received in July. Andrew Rosewater, prest. B. P. W.

Marysville, O.—The council has decided to employ an expert engineer to examine the physical condition of the electric and water plants.

Cincinnati, O.—Specifications were adopted June 10 for lighting this city with electricity for 10 years.

New Orleans, La.—A committee of three has been appointed to investigate the feasibility of a municipal light plant.

Cullom, Ind.—A 20-yr. franchise and a 5-yr. contract has been awarded to E. E. Saylor of Gilman, at $62.50 a month for 2,000 C. P. lights.

Red Wing, Minn.—Sealed bids are asked until 4 p. m. July 5 for lighting the streets for 1, 3 and 5 yrs. C. E. Harrison, cy. clk.

West Orange, N. J.—The contract for lighting the streets and public buildings with arc lights for 1 yr. has been awarded to the United Electric company at $90 each.

Kansas City, Mo.—An ordinance has been introduced in the council providing for $300,000 bond issue to be expended in building a municipal lighting plant.

The question of issuing bonds for electric light plants have been favorably voted on at the following places: Chillicothe, Mo.; Mayville, Mich.; Murdock, Minn.; Frankfort, N. Y.

Cincinnati, O.—Sealed bids are asked until July 19 (extension of date) for lighting the streets, lanes, squares and public places with electricity for 10 yrs. Edward Henderson, cy. clk.

Indianapolis, Ind.—Special proposals are asked until July 15 for furnishing public, private and commercial electric lighting, and for the letting of a franchise if necessary, for the use of the streets, alleys and public places for supplying such lighting. Albert Sahm, chm. B. P. W.

Electric light plants are contemplated at the following places: Ipswich, Mass.; Groton, Vt.; Warren, O.; Windfall, Ind.; Atlantic City, N. J.; Lompac, Cal.; Bloomington, Wis.; Paris, Ill.; Washington, Ia.; Media, Pa.; Geneva, O.; Oneida, Ill.; Paris, Mo.; Beloit, Kas.; Ballston, N. Y.; Ashpole, N. C.; Auburn, Neb.; San Jose, Cal.; Glance Bay, Ont.; Murdock, Minn.; Union, N. J.; Mayville, Mich.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Burlington, N. J.—The work of street cleaning will be let by contract.

Coshocton, O.—The question of cleaning paved streets is being considered.

Anderson, Ind.—The question of garbage disposal is being considered.

Orange, N. J.—The council has appropriated $20,000 for a garbage crematory.

Oakland, Cal.—The board of public works was authorized June 3 to ask for bids for street sweeping.

Watervliet, N. Y.—The city clerk was authorized recently to ask for bids for cleaning the streets and alleys, commencing July 11th.

Erie, Pa.—Specifications have been prepared for cleaning the paved streets in the Third and Fourth wards.

Newport News, Va.—The contract for constructing a garbage crematory has been awarded to the Bridgeport Boiler Works company of Bridgeport, Conn., for $7,400, including brick chimney.

New York City—Bids are asked until July 3 for street sweeping and the collection of ashes, garbage, etc. T. M. Gibson, deputy, Com'r. Dept. St. Cleaning. A resolution will be introduced in council asking for plans for garbage crematories.

TOO LATE FOR CLASSIFICATION

Moline, Ill.—An ordinance was passed, for paving Nineteenth-st. with asphalt.

Albia, Ia.—The contract for brick paving and curbing was awarded to Magden & Sheeley, of Des Moines, for about $25,000.

Marinette, Wis.—The residents on Liberty-st., west of Stephenson, contemplate putting in cement walks this year or next.

Mt. Vernon, Ind.—Sealed bids are asked until 4. P. M. July 8, for paving Main and Second-sts., with asphalt. Frank Smith, cy. clk.

Sioux Falls, S. D.—Resolutions have been passed to construct cement walks on Sixth, Eleventh and other streets. Geo. W. Burnside, mayor.

St. Paul, Minn.—Estimates have been submitted by the city engineer for boulevarding and curbing St. Albans and Dale-sts. with sandstone or granite.

Chicago, Ill.—Ordinances were passed, June 25, for asphalt paving for N. Kedzie-ave., N. Morgan, W. Ohio-st.; slag limestone on granite, W. Lake-st.

Columbus, O.—Mayor Hinkle is urging an appropriation of $500 for an engineer to look into the matter of a site for the proposed electric light plant.

Lampkin, Ga.—The contract for an artesian well has been awarded to H. R. Teal. With artesian water in view this town has voted bonds for complete water works.

Newark, N. J.—The specifications and form of contract for the construction of the proposed storage reservoir at Cedar Grove are completed. Engr. Sherrerd.

Glenville, O.—The citizens have petitioned for improving as boulevards, Salisbury and Lewis-aves., Burton and S. Haldeman-sts., and Lake Shore boulevard.

Ottumwa, Ia.—The question granting franchise to the Ottumwa Electric & Steam Co., for a railway system, an electric light plant and heating system, will be voted on July 8.

Minneapolis, Minn.—Resolutions have been passed providing for artificial stone sidewalks, and curb and gutters, etc., on a number of streets. A. A. Ames, mayor; L. A. Lydiard, cy. clk.

St. Paul, Minn.—Sealed bids are asked until July 8 for macadamizing E. Seventh-st. and paving with asphalt Marshall and Western-aves., and Central Park Place; sandstone, Minnehala-st.

Benton Harbor, Mich.—Plans, specifications and estimates have been accepted for paving Sixth, Wall, E. Main and Pleasant-sts., and a meeting will be held July 8 to decide upon the kind of material to be used.

Plymouth, Ind.—Sealed bids are asked until 7:30 P. M. July 1 for paving with brick and curbing a portion of Michigan-st., 13,000 sq. yds. Sealed bids are asked until 7:30 P. M. July 15 for curbing and paving with brick portions of LaPorte and Michigan-sts., 5,000 and 15,000 sq. yds. respectively. Arthur E. Rhodes, cy. clk.

Fairfield, Ia.—(Special.)—J. F. Dearduff, cy. clk., says that this city will have to readvertise for bids for paving, and as the season is now so far advanced, and another election will be necessary before the city council can proceed with paving, it is not probable anything more will be done this year. Joseph Ricksher, mayor.

Indianapolis, Ind.—Final action was taken June 27, for paving with creosoted wooden blocks, cement walks and curbing, Arch-st. from Park-ave. to Broadway-st.; graveling and grading, cement walks and curbing Vermont-st. from Lynn to Bank-ave.; cement walks in Russell-ave., from Meridian-st. to McCarty-st. Specifications were submitted to the board of public works, June 28, for a new stone bridge over White river at Washington-st., and bids will be asked at once. B. J. T. Jeup, cy. engr.

Wapakoneta, O.—(Special)—Samuel Craig, city engineer ,says the contract for paving Blackford-st., was awarded to Gantz & Parody, of Columbus, O., at the following prices: Exca., 29 cts. a cu. yd., 5-in. gravel concrete and 1-in. sand, 40 cts. a cu. yd.; Portland cement filler, 10 cts.; Berea curb, 5x18-in., set in concrete, 48 cts. a lin. ft.; circular curb, 96 cts.; holders, 20 cts.; catch basins, $22; inlets, $15; 24-in. pipe laid, $1.25; 18-in., 95 cts.; 15-in., 80 cts.; 12-in., 65 cts.; 10-in., 48 cts.; 8-in., 38 cts.; 6-in., 32 cts.; 15-in. T's and Y's, $1.40; 12-in. plates, 5 cts.; masonry, $1.75; resetting electric light poles, $20; Wassal brick and sand cover, 81 cts. a sq. yd.

Indianapolis, Ind.—Sealed bids are asked until 10 A. M. July 3 for grading, graveling, paving gutters with brick, curbing with stone and building 5-ft. cement walks on Northwestern-ave., from Fifteenth to Twenty-First-st., paving gutters with brick, stone curbing, cement walks, Northwestern-ave., from bridge over Fall creek to Thirty-second-st., grading, graveling and rolling roadway, paving gutters with brick and stone curbing, Southwestern-ave., from Rural-st., paving sidewalks of Pennsylvania-st., from Thirty-second to Thirty-fourth; creosoted wooden block paving on concrete, with stone curbing, New York-st., from Noble-st. to C. C. C. & St. L. R. R. tracks; cement walks on Minnesota-st., from East to Orleans on the southside, and from East to the second alley east of East-st. on the north side. Albert Sahm, chmn. B. P. W.

East Dubuque, Ill.—Sealed bids are asked until July 2 for building a brick sidewalk in Sinsinnawa-ave. Cy. clk.

Upper Sandusky, O.—Sealed bids are asked until 12 m., July 2, for grading and graveling a road. E. L. Helbedel, co. audt.

Indianapolis, Ind.—Sealed bids are asked until July 1 for brick and asphalt paving on portions of two streets. Albert Sahm, chm. B. P. W.

Lorain, O.—Sealed bids are asked until 12 m July 1 for paving E. Erie-ave., from the bridge across Black river to Fifth-st., with brick, and for grading, draining, curbing and paving Second-ave., from Broadway to Washington. J. J. Mahoney, cy. clk.

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